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ABSTRACT

In recent years emphasis has shifted from physical to human capital as a key factor in economic growth. Both government and business have intensified efforts at manpower planning to improve the utilization of human resources. These papers by representatives of government and business cover various aspects of labor market efficiency. The nine papers include: (1) Investing in Human Resources, (2) Government Techniques for Projecting Occupational Manpower Needs, (3) A Company Technique for Estimating Future Manpower Requirements, (4) Accommodating Short-Term Fluctuations to Long-Term Manpower Planning, (5) Dealing with Imbalances in the Labor Market for Scientists and Engineers, (6) Fulfilling Requirements for Specialized Manpower, (7) Evolution of Career Paths, (8) Converting Hard-Core Unemployed into Productive Contributors, and (9) The Task Force Approach to Effective Manpower Utilization. (BH)

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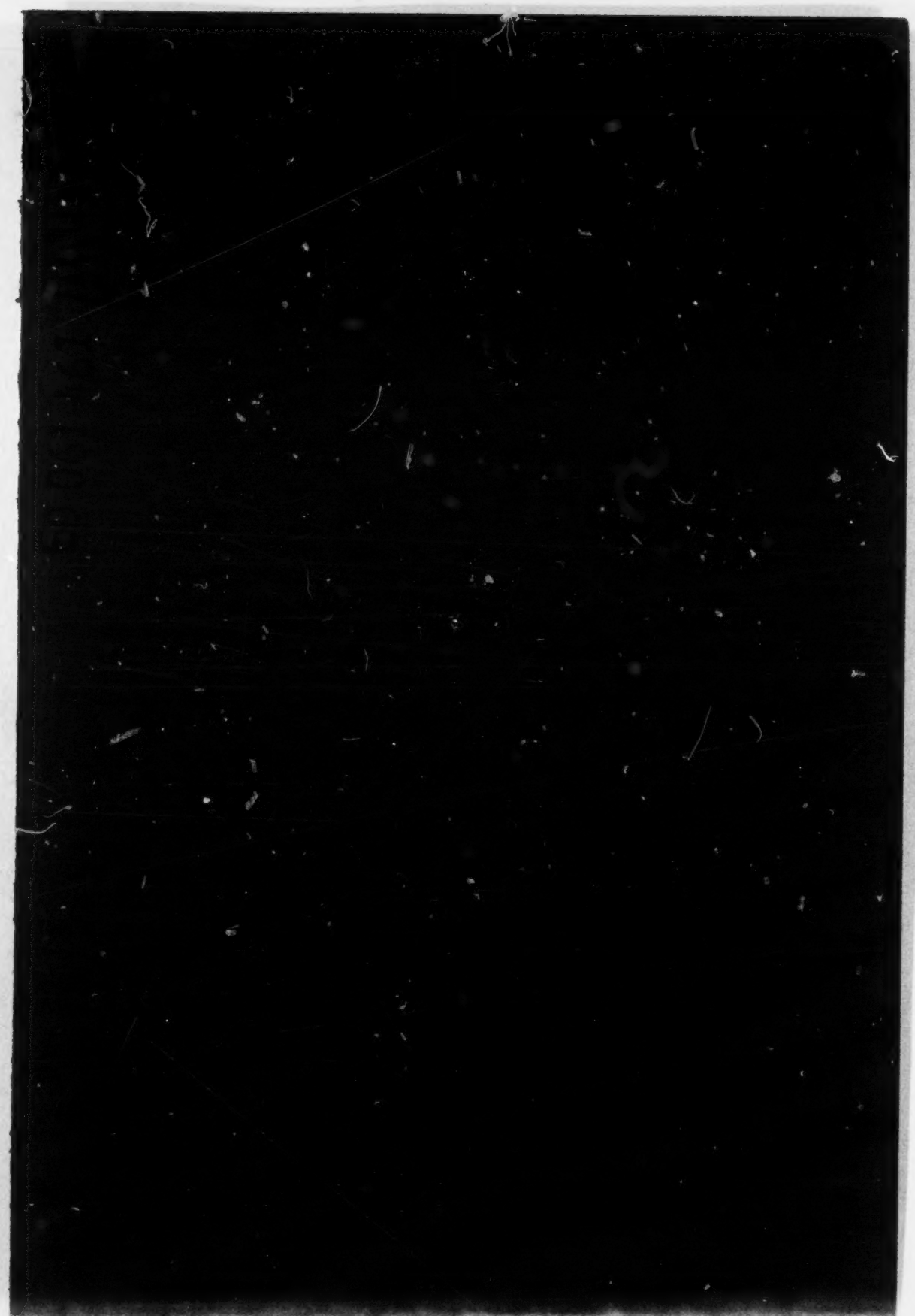

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Manpower and Planning

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Papers Presented at the

IRC Symposium

Held at Morristown, New Jersey

September 25-27, 1968

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Industrial Relations Monograph, No. 31

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At the time Industrial Relations Counselors was formed, it was the only organization in the United States focusing on industrial relations research and its practical application. The research activities of Industrial Relations Counselors have been facilitated over the years by its continued close relations with an ever growing number of companies representing a cross section of industry and commerce, both here and abroad, and with governmental, professional, educational, and other groups interested in the industrial relations field.

Today, as in the past, IRC is concerned with anticipating developments in industrial relations and with undertaking research that provides industry and the public with the knowledge required to meet future challenges and to cope with today's needs. A list of studies published by IRC is available on request.

IRC also presents a number of conferences and training sessions for the purpose of exploring industrial relations theory and practice. These sessions include an Annual Symposium on Advanced Research in Industrial Relations, and Management Courses in Industrial Relations at Williamsburg, Virginia.

Preface

For many years economists and others concerned with economic development have attempted to isolate the variables which lead to, or obstruct, economic growth. First, capital was seen as the key to economic progress; in more recent years, however, attention has shifted to the human resource input as it became apparent, at least in the United States, that the increase in the size and caliber of our labor force was an important factor in our high level of economic achievement.

With recognition of the importance of human resources has come renewed interest in the field of manpower planning on the part of both government and business. Programs in each area have grown rapidly in recent years as the need to match people and jobs has become increasingly evident at both extremes in our labor force structure. The shortage of high-talent managerial

and professional manpower has placed special pressure on business to recruit and select these people and to utilize them effectively. At the other end of the scale, the nation has grappled with the problem of converting the deprived and uneducated into productive workers.

Surveying the overall picture, we find government and private business operating not in opposition or in duplication of one another's efforts but in complementary ways. The federal government, focusing largely on the broad aspects of manpower, gathers data and surveys the supply of and demand for labor on national and sectoral bases; the individual business unit, for its part, is learning to use these government services and projections as the starting point for its own manpower planning. Today, most American companies of any substantial size have at least begun to explore and anticipate their manpower needs, and to attempt to predict future staffing requirements and to outline programs to develop men to meet future responsibiliites.

These tasks, and the need for other related efforts in manpower planning, are highlighted in a dynamic industrial economy such as ours, in which the scene and cast are constantly changing as old industries decline and new ones arise. Decisions on plant location, once heavily dependent on the source of raw materials, are now market-oriented. As many of us know too well, the job of staffing a new plant in an area previously devoid of industry is not an easy one, since employees not only may have to be recruited elsewhere, but also may have to be transferred across the country and trained locally. In addition, technologies are changing rapidly, making many of the skills in demand today obsolete tomorrow. Thus, we find ourselves in a continuing race to keep abreast of new job requirements.

The days when the personnel man could draw on the ranks of the unemployed for a supply of additional workers are gone forever. Every firm competes for manpower with every other firm, government agency, and educational institution. Workers

have choices of jobs and, given our level of affluence, they seek work that is meaningful and well paid.

In such a setting, ensuring the firm's supply of qualified manpower requires more than lip service to the concept of manpower planning. Despite the extent of company concern over manpower problems, very little systematic forecasting and planning has been carried out. In organizing this Symposium, therefore, Industrial Relations Counselors hoped to provide an opportunity for manpower planners to survey what has been done in various company and government programs and to explore common problems.

We were indeed fortunate to have as speakers representatives from the federal government and several pioneering companies in the field. Their experiences, which they graciously consented to share with us, are published in this volume with the hope that they will make a significant contribution to both government and company efforts for better planning and utilizing manpower, the nation's most valued resource.

Richard A. Beaumont
President
Industrial Relations Counselors, Inc.

New York City, March 1970

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Investing in Human Resources

RICHARD A. BEAUMONT

President, Industrial Relations Counselors, Inc. Mr. Beaumont has long been active in the management organization and industrial relations field. He joined Industrial Relations Counselors in 1958, and in 1961 became director of research; he was made president in 1964. From January, 1966, to August, 1967, Mr. Beamonut was on leave, serving as Deputy Under Secretary of the Navy. He has served as a consultant to major corporations in this country and abroad, to the Department of the Navy, and to state and local government, and is also president of Organization Resources Counselors, Inc., a New York management consulting firm. Mr. Beaumont's publications in the industrial relations field include *Productivity and Policy Decisions, Executive Retirement and Effective Management,* and *Management, Automation and People.* He is also the author of "Environmental Factors in Collective Bargaining" in *Frontiers of Industrial Relations,* published by California Institute of Technology. He attended the University of California (A.B., 1950), the University of Hawaii (M.A., 1956), and Columbia University Graduate School of Business.

Investing in Human Resources

RICHARD A. BEAUMONT

In recent years the need for effective manpower planning has been increasingly apparent. Currently, there is probably no issue of greater concern to company managements than the question of how to attract needed talent to their organizations and how to retain and productively utilize it.

The importance of effective utilization of human resources is not a new concept. Early in the 1900's, Alfred Marshall, the classical economist, observed that the most valuable of all investment was the capital invested in human beings. From this principle stemmed a great series of ideas, as well as numerous controversies among economists and sociologists as to the best approaches to managing the human factor. It is only recently, however, that we in the business community have been giving constructive and systematic thought to the subject.

IMPLICATIONS OF INTERNATIONAL EXPERIENCE

The greatest impetus toward systematic human resource development programs came with the end of World War II, as the United States and other industrial nations began to recognize an obligation for assisting the emerging nations of the world to realize their economic potential. The question of how to best help these nations advance led to a unique concept in national political and social thinking — we began to discover that investment in human resources might be more essential to a nation's economic growth than investment in equipment, plants, or natural resources. For without development of human capabilities, our ability as a nation to help other nations simply did not transmit itself in any meaningful way and with any particular long-term impact on their economies. Regardless of how many dollars we invested, regardless of the size of the Peace Corps or the "Paunch Corps," we were never able, without the aid of qualified, capable nationals, to create the chemistry conducive to a viable economic system. We learned that lesson — and I think we learned it reasonably well.

Our experience in the international sphere also raised other questions with significant implications for company manpower planning and development efforts. First of all, how can the effectiveness of an investment in human resource development be measured? Congress grapples with this issue annually, in terms of measuring in value received all the money that has been channeled into Vietnam for the training of local nationals. In the absence of a capability to measure the effectiveness of this investment, should the United States continue to invest dollars?

If you think this an idle question, recall the systematic reduction in the budget that occurred when the Agency for

International Development was unable to measure the effectiveness of the monies it had authorized for expenditure abroad. This once proud agency, while left with a mission, lacks the funds to have the impact once envisioned.

Second, internal development programs, whether sponsored by government or by the great foundations of this country, inevitably face the problem of marshalling the funds necessary to maintain a continuing thrust. For certain types of projects it is sufficient to inject money at one point, stop, and then inject again. In developing human resources, however, this is not possible, for once monetary assets are injected the need becomes self-perpetuating, even though financial support may not be available on a continuing basis. A recent program for the development of social and economic systems in Peru is a clear illustration of how loss of continuing support led to ultimate failure of an effort that had been marked by notable early success. The same problem of support for manpower planning activities arises in business when downturns in the economic cycle occur, and here it usually manifests itself in a cutback in college recruitments.

The third problem is how to motivate the people involved to do what they have to, in order for us to help them accomplish given objectives.

These three questions, (1) how to measure the effectiveness of developmental programs, (2) how to maintain their thrust and to ensure continuing support for them, and (3) how to motivate the people involved, are issues significantly related to our own business experience. Before examining this experience, however, let me suggest a few more ideas as background for our consideration of company approaches to manpower planning.

First, there is a difference between an underdeveloped country and the United States. We are, after all, fairly advanced and have a sophisticated economic system; thus it

could be argued that the same issues in manpower planning do not pertain in the United States as they do in an emerging economy. I would suggest, however, that such questions as the foregoing may be more pertinent and more applicable in the United States. Indeed, our problem of human resource development may be even greater, if only because the pace of our technological development is faster. In an advanced system, such as ours, the need for developing people becomes a continuing requirement which cannot be satisfied by an early and one-time investment in education, as once sufficed for a man's lifetime and his career.

Moreover, within the United States, our cities are now encountering many of the same problems as the emerging nation. And even though there are vast differences in the interests of municipal governments and companies, the gulf between them is not quite as wide as it once was. Major American corporations are becoming involved in implementing massive programs in conjunction with city administrations to try to develop human resources for the company and for the social well-being of the community as well.

OBSTACLES TO COMPANY MANPOWER PROGRAMS

In the private sector, management in most areas not only is oriented to the accomplishment of specific objectives and targets, but it is stimulated and motivated by this concept. It would be expected therefore that company manpower planning would begin with clear articulation of what it is that the company needs or expects to accomplish through its investment in human resources. I do not know of any company, however, that has done a completely adequate job in developing goals and targets for manpower planning and development.

There would appear to be a number of reasons for this

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failure. Among them are training difficulties, the lack of balance in long- and short-term objectives, breakdowns in planning capabilities, the need for constant adjustment to change, and the lack of incentives to encourage individual initiative.

Failure to Recognize Future Training Returns

One of the major obstacles is the difficulty of selling line managers on the value of certain types of training. If the line manager can see readily that a specific job requires education or further training of employees, there is rarely any difficulty in persuading him and the company to make this investment. The problem arises when education and training are necessary but not obviously work-related. For example, compare the relative ease of selling a traffic training program with the difficulty of selling a program designed to prepare middle managers for higher level assignments, or the ease of gaining support for professional and technical training in contrast to selling supervisory and managerial training. Companies usually find no difficulty in sponsoring seminars for their technical people, but creation of an environment that will stimulate the development of supervisors and of managers often appears to present insurmountable obstacles.

Stating it very simply, certain types of training are acceptable to the line manager because he can see the results translated fairly quickly into specific job improvements, but he is inclined to distrust training efforts that have no observable impact or are not related to immediate profit improvements in his area of responsibility. In fact, he may often actively resist suggested training for his subordinates—especially if the release of key people for training assignments means that certain short-term objectives have to be sacrificed or that these goals will be harder to accomplish.

In all training—whether for short- or long-range purposes — a certain element of faith is essential and must be imposed

upon the system by the line manager as part of his responsibility for getting the job done. Failure to understand this results in neglect of long-term training needs and produces eventually a dearth of qualified manpower. I do not say that the lack of commitment to long-term training values is universal among managers, but it is widespread enough to be symptomatic of a general weakness in management.

Confusion in Short- and Long-Term Objectives

A sound manpower planning and development program involves effective coordination of both immediate and long-range objectives, which is frequently difficult to achieve because of inherent differences between the short and long term. In contrast to manpower requirements for five or ten years in the future, immediate needs are readily apparent and relatively easy to deal with. Hence in most companies concern in manpower planning tends to focus on the present, while future objectives and needs — the bigger problem — are ignored. Actually what is involved is the very practical problem of separating the near from the long term, so that Joe can be moved into the job which Sam will vacate at the end of the year, while at the same time Mr. X, who is not yet on the scene, can be recruited and prepared for the job that Joe will go into some years down the road.

Maintaining Manpower Planning Capabilities

A third problem is the breakdown in manpower planning capabilities that occurs, first, because of fluctuations in the business cycle and, second, because of the fuzziness that characterizes much long-term developmental planning at the corporate level.

In too many companies, the manpower plan is compromised, and even scrapped, whenever an economic downturn

occurs. Faced with an economic disruption, managers tend to think: "We'll get by this year without additional manpower; by next year we will have made the major investment in the new steel mill, or refinery, and then we will be all right and can begin recruiting again." Yet experience since World War II indicates that short-term business cycles are now characteristic of our economy. The periodic nature of these short-term adjustments has caused problems in all areas, and it creates particular difficulties in manpower planning because of the impact on recruiting.

We are going to have to learn to live with short-term shifts in the economy. Anticipating them and working out ways to counter them, without sacrificing manpower plans, must become essential factors in our planning.

Manpower planning capabilities also break down when planning is attempted without a sufficiently clear view of what the company is going to be or look like in the future. Without such a concept, it is indeed difficult to determine the types of manpower that will be required and how these human resources should be developed.

Undoubtedly, the whole area of business planning needs closer attention. Often the manpower side of the planning equation is neglected. To some extent, however, this is the fault of manpower planners, because they are failing to sell line managers on important manpower concepts so that they comprehend the necessity of incorporating manpower needs in the overall business plan.

The Dynamics of Manpower Planning

Manpower planning and human resource development involve truly dynamic concepts — ones which change as each new element of technology is introduced and as new directions are taken in the business organization. You probably know

this better than I, since all of your companies have been engaged for some time in adapting new technologies and in opening up new avenues of business. Think back for a moment about the number of products your company is producing now that it did not manufacture ten years ago and the number of new businesses it currently engages in that are foreign to its traditional activity. As for the future, what activities will be added, and how many new countries will be included in its locations?

Such changes often are not incorporated into the manpower planning process until after the fact. This was brought home to me by an executive of one of the largest American corporations. He observed that the managers in his company found it difficult to see the company realistically. They constantly referred to "conglomerates" in terms of the several "glamour" companies, but never thought of their own organization in this way. Yet the company had, in fact, become one of the biggest conglomerates in the world, and as such its manpower requirements were far different from what most of its managers generally assumed.

Every company represented here has experienced and is experiencing changes in product line, in geographic dispersion of operations, and in other aspects of its business, and these are affecting the character of the manpower problems that its management must solve. Moreover, the range of these manpower considerations, though broad today, will be even broader in the future. Thus, one of the fundamental questions for today's manpower planners is whether or not they are orienting their managements to the concept of change and its implications. Are people within their organizations being made to realize that the career path that has been historically appropriate — let us say in an oil company, up to refinery manager and into headquarters, and on up into the organization—is not necessarily the career path of the future? How

can it be demonstrated that career paths embedded in the past culture of the organization may not currently be the way for able men to move ahead?

The company environment today also demands changes in the attitudes of individuals in the organization regarding their own futures. A man who has reached a fairly high level of attainment by age 40 or 45, and who expects to continue to move ahead, must understand that his further success will be contingent on his willingness to involve himself in broadening educational experiences that enlarge his capabilities. It is easy to castigate company managements for failing to think through their manpower planning needs, but many times the problem lies with the individual employee who, having advanced to a certain stage, considers that he has "arrived." Thus, manpower planners have the challenge of orienting individuals to the concept of a career as a continuing process of work and learning —not as a series of disconnected happenings at different points in time, with learning occurring in the first phase of the cycle, and work and promotions following as a subsequent but separate step.

Interconnecting the company's needs with the individual's desires is another but equally important issue in manpower planning. It is essential to have a communications or information flow that coalesces the company's interest in investing in manpower development with the ambitions of the men ready to profit from this investment. Fundamentally, this problem is one of balance. Participation in management development programs must be encouraged, but balance also has to be maintained, in providing opportunity for those who can best use it, in denying opportunities to those who lack sufficient potential, and in restraining those overambitious individuals who prematurely and indiscriminately seek avenues for their own development.

The Need for Better Individual Incentives

A final problem in manpower planning is the need to stimulate individuals to pursue their special interests and desires quite apart from the cultural framework of their particular organizations, or the career path concepts and traditional patterns of advancement in our social system. In this connection, reward and compensation systems need to be designed to motivate individuals to take more initiative themselves in speeding their growth. How many of our companies today relate management compensation to factors other than specific performance on the job? How many reward an employee for his receptivity to concepts and ideas that are not entirely work-related? How many have used organizational development training or advanced management training techniques to foster the individual's desire to broaden himself as he works and learns within a structured system?

Most company programs, whether compensation or training and development, are tied solely to recognition of current efforts rather than to motivating the individual to prepare for future job requirements. In order to do the latter, quite revolutionary ideas must be developed by those responsible for planning and executing the manpower planning and resource investment program.

ELEMENTS OF A MEANINGFUL MANPOWER PROGRAM

In my work with various company organizations I have found that manpower planning and resource development efforts almost invariably lack certain key characteristics which, if present, would serve to catalyse disparate elements. Too much attention seems to be focused on discovering a mechanical procedure for accomplishing the necessary planning job. The following are typical questions: "How is company X

tying business development in with the manpower planning capability?" "How can an organizational relationship between the two be established?" "Is company X really projecting manpower needs ten years down the road and grinding them into their equation?" "What specific steps are included in the manpower planning process?"

Such questions, it seems to me, are not the essential ones. Concern should center on how to develop an all-embracing "umbrella" concept that will encompass all elements of manpower planning and tie them together in an integrated effort. Such a program is possible and its elements are described below.

The Management Resources Plan

Under the "umbrella" of management resource planning there are six major elements. Some are familiar and therefore need no special elaboration; others will be discussed in greater depth in the next two and a half days of our Symposium.

Using the jargon peculiar to the field, I refer to this approach not as "management development" or "organization development" but as "management resource planning." This phraseology was selected specifically because it is more likely to make sense to hardheaded, pragmatic line management people. I have discovered, and I throw this out as a caveat, that manpower planners who talk in terms of organization development and organizational theories encounter difficulty with their superiors partly because their terminology fails to express the urgency and complexity of manpower planning.

1. *Establishment of manpower requirements.* Element No. 1 is the familiar management manpower plan which relates manpower needs and long-term, intermediate, and short-term corporate business plans. It is the manpower plan that sets forth quantitatively and sometimes qualitatively the manpower requirements of the business. Considerable work has been

done in this area by many companies. A number, in fact, have channeled all their efforts into this single plan, which in my view is to deal with only part of the total task.

2. *Development of management potential.* The second element encompasses five subsystems which make up the management development plan.

—A management inventory, which specifies the resources at hand. (Most of you have management inventories that systematically identify current talent, wherever it may exist in the organization.)

—A position replacement roster, which indicates who should be moved into openings expected to occur in the near term as employees transfer, die, resign or retire.

—A management potential roster, which identifies individuals with potential who must be developed to fulfill requirements still fairly far in the future.

—A performance and potential development plan, which identifies not people, as the preceding systems do, but the types of training and experience needed to prepare individuals with potential for future job assignments.

—The recruitment plan, which keeps the pipeline full.

You can see what I am trying to suggest here; namely, that an inventory system alone is not sufficient—that further steps are needed to tie the parts together to create a unified and coordinated development plan.

3. *Compensation.* The third element is the salary administration plan, which is the reward system for those doing today's job. Its purpose is to ensure that the compensation system continues to provide incentive to men to "learn while they earn," even though they already may be high-level and excellent performers.

4. *Clarification of performance criteria.* Fourth is the performance standards plan. Such a system provides a basis

for judging how well a man is discharging his current job responsibilities in relation to the corporation's current objectives.

5. *Review of performance.* Fifth and most critical is the review plan, the purpose of which is to evaluate what a man has done in the near term.

6. *Assurance of management commitment.* Sixth is an element usually missing in manpower planning—management commitment. This plan is the final step, and it closes the loop. Fundamentally, the purpose is to evaluate high-level managers on the discharge of their responsibilities under the Management Resources Plan. Executives are asked, as a basis for their participation in bonus, stock option or other executive compensation plans, how much they have contributed to the corporate well-being by guaranteeing that future manpower requirements will be met. Integration of this factor into the planning process should assure the company that its managers are fulfilling their commitment to organizational concepts that guarantee continuation of the development cycle and that they are communicating that commitment.

Indeed, it is possible to go so far as to develop for each of a company's profit centers a manpower balance sheet that reports the status of the manpower assets for which a given manager is responsible. Each year these assets would increase or decrease as a result of transfers, resignations, retirements, and deaths of employees in the manager's area, and each year the manager would be required to rebuild his assets by investing in human resource training and development. A balance would be tallied annually, against which a corporate overhead factor would be imposed, reflecting the fact that each year the company might withdraw from a manager certain of his manpower assets, in order to fulfill companywide requirements.

Development of such a system is not easy, but would be no more difficult to work out than the arbitrary type of scoring

system used in job evaluation. Though artificial, it would evaluate the human resource assets within a manager's purview and help him keep track of their development over a specified period. Moreover, it would commit line management to essential manpower planning responsibilities on a logical basis. Otherwise, manpower planning might easily become an artificial function unrelated to actual company plans.

Management resource planning, then, involves taking the various elements which typically are scattered throughout employee relations and personnel functions, pulling them together, and integrating them into a system capable of ensuring effective manpower planning and utilization within the organization. This is a big job, and it is far more complex than the approach usually taken in manpower planning.

Location of the Manpower Planning Responsibility

Many managements are reluctant to undertake a program as broad-based as the Management Resources Plan. One reason is a fear that the person who could successfully direct it might become a "king-maker" and gain totally unacceptable control over the organization. While it is unlikely that any chief executive would permit this to happen, the question of responsibility for manpower resource planning is an important one, and not easy to resolve. Moreover, in view of the influence which might be derived from the manpower function, there may be a valid basis for questioning if administration of a management resources plan can realistically be part of the personnel program.

Because of such doubts, some companies which have set up a manpower planning function have superimposed it on the personnel organization. By elevating the function in this way they have brought it closer to the chief executive. In other instances, a high-level development and management resource

plan has been established and placed directly under the personal purview of the chief executive.

While there is no special justification for the top executive's assuming this responsibility, there is reason to believe that the personnel organization may not be the best equipped to manage such a plan. First, personnel people are inclined to be more concerned with the system involved than with what the system is designed to do or the contribution it should make to the business programs, policies, and plans of the organization. Second, it is difficult for a personnel organization to undertake the kinds of activities described here because the employee relations function is frequently not in close touch with organizational developments within the company. It is for these reasons that we are beginning to see the evolution of corporate-level organization and manpower planning departments that are pulled together by the chief executive officer himself. Nonetheless, there is a real challenge for personnel people to prove that they are capable and qualified to become involved in broad-scale planning efforts of the type envisioned here.

The details of the manpower resources program and of the departmental structure for administering it will vary considerably from company to company, because such a program will have to be tailored to each company's particular culture. You will notice that I am now saying "will have to be tailored," as though I have absolute faith that management resource planning will be an accepted function in the years ahead, and I think that it will.

SUMMING UP

I said earlier that in manpower planning and development we are confronted with three major problems: measuring the effectiveness of the program, maintaining the program's

continuity, and engendering support for that program. It is certainly appropriate to deal with these problems—and many of us are—but it is still too early to measure the effectiveness of manpower development programs. We cannot yet cite their specific contributions in the business world at large. However, X years from now it will have to be possible. Organizations today are already seeded with line managers who are beginning to understand and develop their internal manpower resources. The issue is whether staff people will move as fast as their bosses in translating needs into action.

Concerning the problem of maintaining thrust and continuity, I suggest a highly developed system, such as the Management Resource Plan, because it can bind the organization to the commitment that is necessary. Perhaps by injecting in the manpower system controls similar to those found in budget and financial systems, one can maintain the desired thrust and at the same time make it possible for line management to do the job that has to be done.

Support for effective manpower programs is present in organizations today but it is latent; the essential concepts have not yet fully evolved in the typical corporation. Currently, therefore, the problem is one of motivating the individual line manager to participate. Actually we know enough collectively, if not singly, to get managers personally involved, personally committed, and deeply dedicated to their own self-development. But changes will be necessary in the reward system and culture patterns of our companies, so that, in addition to the satisfactions which come from work and from work alone, the rewards will flow for the man who grows and learns in preparation for his future.

In summary, I have tried to say, first, that we have learned some lessons from the economists and from our government's efforts in developing countries, and that there are parallels to be drawn between what happens in the world at large and

what happens within our companies. In the latter, there are real problems in implementing programs that effectively relate the developmental needs of people to what we do. Most of these problems can be encompassed, however, in a systems-oriented approach, which I identified as management resource planning. This approach takes all the elements of manpower planning and development and organizes them into a meaningful whole to entrap, as it were, both the organization and its people in building for the future. There may be some real question as to whether or not we in the personnel field can do the job that has to be done. My conclusion is that I think we can — but I am doubtful that we will.

Finally, the need for manpower planning is greater now than it has ever been. To quote John Gardner:*

> The demand for high-talent manpower is firmly rooted in the level of technological complexity which characterizes modern life. . . . In a world that is rocking with change, we need more than anything else a high capacity for adjustment to changed circumstances, a capacity for innovation. The solutions we hit on today will be outmoded tomorrow. Only high ability and sound education equip a man for the continuous seeking of new solutions.

My experience, gentlemen, has been that this is what business is all about—the continuous seeking of new solutions in an increasingly complex and technological framework. You and I will not be qualified tomorrow unless we do something today, and the same holds true for each and every person from the recent college recruit to the 60-year-old executive.

*_Excellence_, Harper & Row, New York, 1961, page 34.

Government Techniques for Projecting Occupational Manpower Needs

HAROLD GOLDSTEIN

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Government Techniques for Projecting Occupational Manpower Needs

HAROLD GOLDSTEIN

In the years ahead, the job of manpower planning can be expected to become increasingly vital to company managements. In the second half of the 1960's, the United States experienced a period of sustained business prosperity, in which employment and production grew steadily and the rate of unemployment declined. It is the effect of these forces that is currently being felt by businesses in their hiring and recruiting efforts.

Though complacency regarding our ability to manage the economy would be out of order, it is probable, looking ahead, that present conditions will not change drastically. For several

reasons, fairly high levels of employment and production will be sustained:

1. The federal government is dedicated, under the Employment Act of 1946, to maintaining high levels of employment, and it is under immense political pressures to do so.

2. Experience and tools have been acquired for effecting economic adjustment. Although there are still great rigidities in using these adjustment measures, and often they cannot be applied as readily as would be desirable, they have worked fairly well.

3. Better and more refined methods have been developed for measuring what is happening in the economy and for more quickly supplying information on what is needed in order to manage it.

IMPLICATIONS FOR GOVERNMENT AND INDUSTRY

Under present conditions both government and industry have a deep concern and an interrelated interest in long-term manpower planning.

Assuming continuation of low unemployment levels, the implications for industry are fairly obvious. For one, it will be necessary for employers to direct manpower planning to all skill levels—to production occupations as well as to executive and highly skilled professional groups. No longer can the availability of skilled workers be taken for granted. Hiring standards will have to be adjusted, and initial skill deficiencies will have to be overcome by in-service training up and down the skills ladder.

With labor reserves dwindling, but a continuing problem of unemployment and underemployment in certain groups, industry will have to pay particular attention to the hard-core unemployed, and to the special problems of personnel man-

agement, in-service training, motivation, and supervision which employment of this group entails.

Companies will also need to examine carefully the problem of turnover. Quit rates should be thoroughly analyzed to determine whether or not training and recruiting funds are being poured into a leaky bucket. There are already indications of heightened interest on the part of employers in studying Bureau of Labor Statistics' monthly labor turnover data, by industry and locality, and in comparing intracompany, industry, and local experience.

In this setting, what is the government's role in manpower development?

A basic responsibility is to ensure that an adequate job of education is done in this country—both in a general sense and in preparing citizens for the professions, the skilled trades, and manual and clerical occupations across the board. In addition, government performs the essential tasks of projecting future manpower requirements for all occupations, of providing information for vocational guidance, and of promoting apprenticeship training, as well as other educational and training efforts, to encourage development of needed skills in sufficient quantity.

Notwithstanding their different roles, company managements and government have a vast area of mutual interest in manpower planning techniques. Companies, for their part, need to project their own manpower requirements, in order to anticipate possible problems in recruitment, training, and other aspects of staffing occasioned by occupational shortages, and to determine the personnel policies needed for salary administration and other employee programs. Since projections of manpower requirements must be tied in with the whole structure of corporate planning, company manpower planners will need some idea of markets and the range of products manufactured. They also will have to understand the structure

of the economy in which their company sells its goods, the competition it faces from other companies and other industries, the demand for its products, the effect of population growth on the labor force, and the impact of technological changes on other industries which may be either purchasers or marketers of its products. For the most part, the company itself cannot supply all these data; it therefore must rely on government and other external sources.

The extent of a company's interest in nationwide projections is most closely related to its internal plans, of course. In addition, if it hires within a total labor market, it needs to know the supply and demand situation in each occupation it employs. Are there shortages in the occupations in which it has specific interest, or is an ample supply of manpower available to meet current needs?

In fulfilling their responsibility for supplying such data, government agencies should be able to look to industry for help in developing long-term projections of occupational manpower requirements. And perhaps this will be possible as industry moves ahead in the field of manpower planning. So far, however, its assistance along these lines has been spotty. Although a number of industry and company planners do a careful and thoughtful job of gathering and projecting manpower data, most of the company statistics available to government are inadequate. Many firms, particularly smaller ones, seem to be staggered by inquiries regarding their future manpower needs, and frequently the company manpower planner, to get the government representative out of his office, answers off the top of his head. What the government usually obtains from industry are many casually derived forecasts; as a result, the Bureau of Labor Statistics has had to rely primarily on an analytical approach to projecting manpower requirements.

BLS MANPOWER FORECASTS

The first projection by the Bureau of Labor Statistics of occupational manpower was completed just after World War II. The effort was unique because for the first time forecasts were developed not for a month or several months ahead but for five and ten years into the future. This was a new and interesting departure for a government agency that had heretofore jealously guarded its reputation for turning out precise and accurate statistics.

Although the Bureau was hesitant to undertake something as nebulous as long-term projections, it saw compelling reasons for supplying this information. For one, young people had to have some information in order to choose careers that would be compatible with future employment opportunities. The Veterans Administration also needed data in order to assist the millions of veterans entering college and other kinds of training programs.

Thus, the projections initially issued by the Bureau were for two purposes: to provide vocational guidance to young students and veterans, and to assist industry, educational institutions, apprenticeship councils, and others responsible for meeting training or educational needs in planning their work.

Despite the wide opportunity for error, the accuracy of the BLS projections has stood the test of time; the general direction and magnitude of employment changes have been predicted with surprising accuracy.

The General Approach

What are the various elements of the techniques and methods used?

In general, as in any analytical method of forecasting, the task is to determine the forces affecting employment or the demand for workers in each occupation and then to project

the effect of these factors. The technique can be illustrated in a simple and straightforward way by projecting, as an example, the demand for teachers. Here the approach has been as follows:

1. The school-age population is projected as far into the future as desired. The proportion of youngsters at each age who would be enrolled in school is then estimated. Developing these figures for elementary schools presents no difficulty, since a very high and constant percentage of the young people of elementary school age are enrolled in school. At the high school and college level, however, a far smaller percentage of school age population participates. Thus projections have to be based more on analysis of social and economic factors.

2. Once school enrollments have been projected, the next step is to quantify the need for teachers. This is done by studying the factors affecting the teacher/student ratio, as well as such institutional considerations as the organization of school systems, the consolidation of rural schools, and the use of special teachers and auxiliary school personnel, including school librarians, nurses, etc. This information can usually be accumulated simply by talking to the people in the field and by observing what is happening there. On this basis, enrollment projections are then translated into the future number of teachers required.

In other occupations, the simple relationship between the occupation and the service performed may be somewhat obscured; thus many more complexities may be involved.

How do we relate the supply of engineers, machinists, stenographers, to the demand for their services?

While one industry is hiring more machinists, another may be introducing programmed computer-directed machine tools, thus reducing its demand for machinists. Still a third industry may be declining despite growth in the economy generally, and consequently need fewer machinists. Therefore, each in-

dustry has to be analyzed separately and on the basis of such factors as its technology, its markets, and the use of one occupation in relation to others. In order to get the total picture, the data are then reassembled. As the manpower market for each industry is analyzed, a part of the total picture emerges, resulting finally in an analysis encompassing all industries and all their markets—in other words, the total economy.

The Projection Procedure

Development by the BLS of manpower projections comprises nine steps altogether. The first eight, of interest to economists primarily, are designed to estimate occupational growth. The last step, which deals with the impact of attrition on company needs, tells as much as half the story.

1. The projection starts with breakdowns of the Bureau of Census population projections, by state, region, age, sex, and color.

2. From study of labor force trends, population projections are then translated into labor force participation rates by age, sex, color, and state and region. The patterns are familiar: participation rates for young people are dropping as this group stays longer in school; rates for older people are declining as they retire earlier; and the rates for adult women are rising as they come into the labor force in increasing numbers.

In short, the composition of the labor force is changing, and one of the current and interesting aspects of this change is that, while the total size of the labor force is increasing, the number of men in the labor force in their late 30's and early 40's is decreasing. This reduction, due to the low birth rates in the 1930's, poses a significant problem for manpower planning because it affects an age group on which industry depends heavily for managerial talent and skilled workers.

BLS projections of labor force participation rates by age and sex, and race, and by state and region are available up to the year 1980. They offer important background data for manpower planning projections by industry.

3. The next step is projection of the gross national product that would be generated by a labor force of the anticipated size, assuming certain hours of work and given productivity rates. Since national productivity has risen about 3 percent a year over the long term, this is the growth rate that is used.

4. Once determined, gross national product is broken down into its major components—investment, consumption, and government expenditure—and models are developed to illustrate the effect on the economic structure of such policy alternatives as high investment, high consumption, or relatively high government expenditures.

5. From each of the models of sectors of GNP, a bill of goods, or consumption estimate, is developed for each type of good and service. In developing these bills of goods — the number of automobiles and the amounts of food and clothing that have to be produced, and the buildings that have to be constructed—family expenditures are examined for changing consumption patterns. BLS surveys of consumer expenditures, by product, are used in analyzing the ways in which family expenditures will change. The end result, at this stage, is the projection, consistent with an overall model, of the final demand for each type of good and service.

6. The sixth step is the conversion of final demand to output from each industrial sector. For the industry that produces a final product—for example, the automobile industry—this determination can be made directly. However, production levels for those industries which produce raw materials or intermediate products must also be estimated. How much steel production, for example, will be consistent with a given level

of automobile output, building construction, or machinery production?

There are several ways to arrive at these estimates. One is by multiple regression analysis—i.e., studying the demand for the production of steel as a function of automobile production, construction, and various other industries consuming steel. A second method, the input-output approach, is also feasible. The Department of Commerce, Office of Business Economics, issues an input-output table that shows what each industry in the United States sells to every other industry. Using this information, and given a production level of, for example, 9 million automobiles, it is possible to determine how much the specified production means to each of the supplier industries — steel, rubber, glass, textile, iron-mining, and electric power, to name a few. Thus, by using either of the above methods, we can then move from a given amount of final product to estimates of production for each industry.

7. Production estimates are translated into employment requirements, taking account of the changing technology of the industry and the changing output per worker. We examine long-term productivity trends in each industry and find out, by talking to people in the industry, what new technologies are being introduced and what other developments are taking place. On the basis of judgments regarding changes in productivity, it is then possible to estimate the number of workers needed for a given level of production of steel or petroleum or coal.

8. Estimates of the number of workers required, derived in the foregoing steps, are broken down by occupational group. Data developed from past records are available from BLS, projecting the occupational composition of every industry in 1975. These data represent educated guesses, based on work done by the Bureau, of the technological changes taking place in particular industries. An industry, for example, that

has been introducing computer-operated machine tools will require fewer machine-tool operators. In another, utilization of computers instead of clerical workers will affect employment of clerical workers, programmers, keypunch operators, etc. All such changes in the occupational structure of an industry obviously have to be taken into account in projecting occupational composition.

Thus, from projection of total manpower requirements in industry, we have moved to forecasts of manpower requirements, by occupation. The result is a range of published projections of the occupational composition of the entire economy, including the manpower requirements for professional occupations, such as engineers, scientists, and physicians; the principal skilled trades; and the major clerical occupations. All of these data are now available for manpower planning and for development of government and industry training programs.

9. The last, and perhaps most significant step, is to project the losses in each occupation resulting from deaths, retirements, and transfers of workers to other jobs. In most occupations, replacements for these losses constitute approximately half of the total number of employees trained; the remaining half are needed to accommodate the growth of the occupation.

The various occupational loss rates are greatly affected, of course, by the age of members of the occupation. In occupations with a slow growth rate in recent years, the average age is high, and the impact of death and retirement is substantial. In those which have grown rapidly, we find many young people, and therefore a low death and retirement rate. Carpentry, for example, is an occupation that has not been growing rapidly, and it has a high average age. Here the annual loss rate due to death and retirement is about 3 per-

cent. Among electricians, on the other hand, the annual loss rate is closer to 1 percent.

When the loss rates for these two occupations are projected over a 10-year period, there is a fairly striking difference between the 10 percent loss for electricians and a 30 percent loss for carpenters, and it very much affects educational and apprenticeship planning for these occupations.

In order to estimate loss rates, BLS has developed actuarial tables of working life similar to the life tables used by insurance companies, which, in addition to death, include rates of withdrawal from the labor force. From these, it is possible to estimate how many people now aged 35 to 40 in a certain occupation will die or retire in the next ten years. By applying these data to the age composition of each occupation, a fairly good estimate of death and retirement losses can be obtained.

BLS tables of working life reflect death and retirements for the economy as a whole; however, if a company has experience data based on its own pension plan records and its own attrition rates, these may be much more relevant.

FURTHER NECESSARY STEPS

There remains the further question of relating the demand to the supply of workers. Will shortages occur or not?

Data are available on the numbers being trained for certain occupations. Annual statistics published by the Office of Education on the number of college and university graduates with degrees in different fields offer some clues to the current flow of workers into each occupation. Allowances have to be made, however, for the number of people who are trained as chemists but who do not go into chemistry, and there is limited knowledge of this very important drop-off. Many students, though trained as chemists, may ultimately study medi-

cine, or go into related fields; women who are trained chemists may turn to raising families. All such shifts must be reflected in order for an estimate to be reliable.

As we go beyond the college-trained occupations, our information begins to dwindle. Records on apprenticeship programs apply only to the number of people trained in registered programs. Since a great many employees are trained in industry programs that are not registered, there is some difficulty in taking this source into account. Adequate information on the output of vocational schools is also lacking.

What is critically needed in most communities—and I strongly urge you to support this as you go back to your locales—is a roundup within each area of the output of various vocational schools, apprenticeship programs—formal and informal—and other in-service training efforts. All such training helps increase the supply of prospective workers, but in very few communities has there been any systematic attempt to pull this information together.

One further step is needed to improve our projections. I have been talking about national projections of the growth of various industries and occupations. Better analysis is needed in both industry and government manpower planning of the geographical dispersion of employment growth, to determine the sections of the country in which employment is increasing and the areas in which it is declining.

Work is going on in regional industry development studies on the techniques for developing projections that reflect population growth in each area and the effects on local employment in an industry of growth in its national product market.

In summary, what can be concluded is this: A great deal of work is being done by government to develop sound national manpower projections and to translate these into state and local manpower projections, for purposes of vocational

guidance and for better planning of training programs. A better job has to be done, however, if industries are to be better able to assess their own internal manpower needs.

As I have suggested earlier, in making its assessments industry can now look to government for a number of aids. National projections of the economy, of the labor force, of markets, and of the demand and the supply of workers in each occupation are available for evaluating future occupational needs; tables of working life have been developed for estimating replacement needs; and data have been amassed on occupational composition patterns in all industries, which may be useful to companies examining their occupational composition in the light of their industry's requirements. Companies may also look to the government for a variety of projections at the state and local levels, and more of these will become available.*

Industry can help by providing information on employment and labor turnover, and on employment by occupation. In turn, government can be of some help in providing projections and techniques that will make the manpower planning job easier. In short, there is room, and an urgent need, for a significant partnership between the government and industry in the field of manpower planning.

*See U.S. Department of Labor, Bureau of Labor Statistics, *Tomorrow's Manpower Needs: National Manpower Projections and a Guide to their Use as a Tool in Developing State and Area Manpower Projections,* Washington, 1969, Bulletin 1606.

A Company Technique for Estimating Future Manpower Requirements

ROGER H. FULTON

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A Company Technique for Estimating Future Manpower Requirements

ROGER H. FULTON

As you are all very well aware, the systematic projection of company manpower requirements is still in its infancy. In fact, it was only in 1965 that Jersey embarked upon its first serious effort to project the company's future manpower needs on a comprehensive basis. We have learned a little about the subject since then, but we are still novices.

I would like to begin by reviewing the value and purpose of manpower projections. Then I want to talk a bit about the central features of Jersey's approach to manpower projection and to analyze the basic factors which shape this approach. With that as background, I can illustrate some of the specifics of our program by reviewing the methodolgy that has been developed.

MANPOWER PROJECTIONS AND COMPANY PLANNING

Since the development of reliable manpower projections requires considerable amounts of an organization's time and talent, it is important before any program is initiated to have a fairly clear fix on how the end product can be used. A clear understanding will be helpful in deciding whether to undertake a projection in the first place, and then in determining the nature and content of the program.

Some uses of manpower projections are well understood and require little elaboration here. For example, any company committed to forward business planning needs to project future manpower requirements to determine prospective labor costs and their potential impact on profits. Estimates of future manpower levels are also needed to anticipate what new facilities must be constructed and how much must be invested in them. If a company has ambitious expansion plans, projections will be valuable in judging the feasibility of these plans from a manpower standpoint. What is less clear, perhaps, is the usefulness of manpower projections in the whole area of manpower management. It is these applications which I would like to discuss.

One of the tenets of manpower planning is that it is necessary at times to deal with employees as groups rather than as individuals. The way in which the company work force is subdivided is therefore of critical importance. One possible subdivision covering the managerial, professional, and technical (MPT) work force of a Jersey affiliate is illustrated in Exhibit 1. Roughly speaking, the MPT categorization encompasses all employees exempt from the overtime provisions of the Fair Labor Standards Act.

In this particular affiliate, the work force has been classified by function (manufacturing, sales, and the like). Each

Exhibit 1

Classification of MPT Job Structure

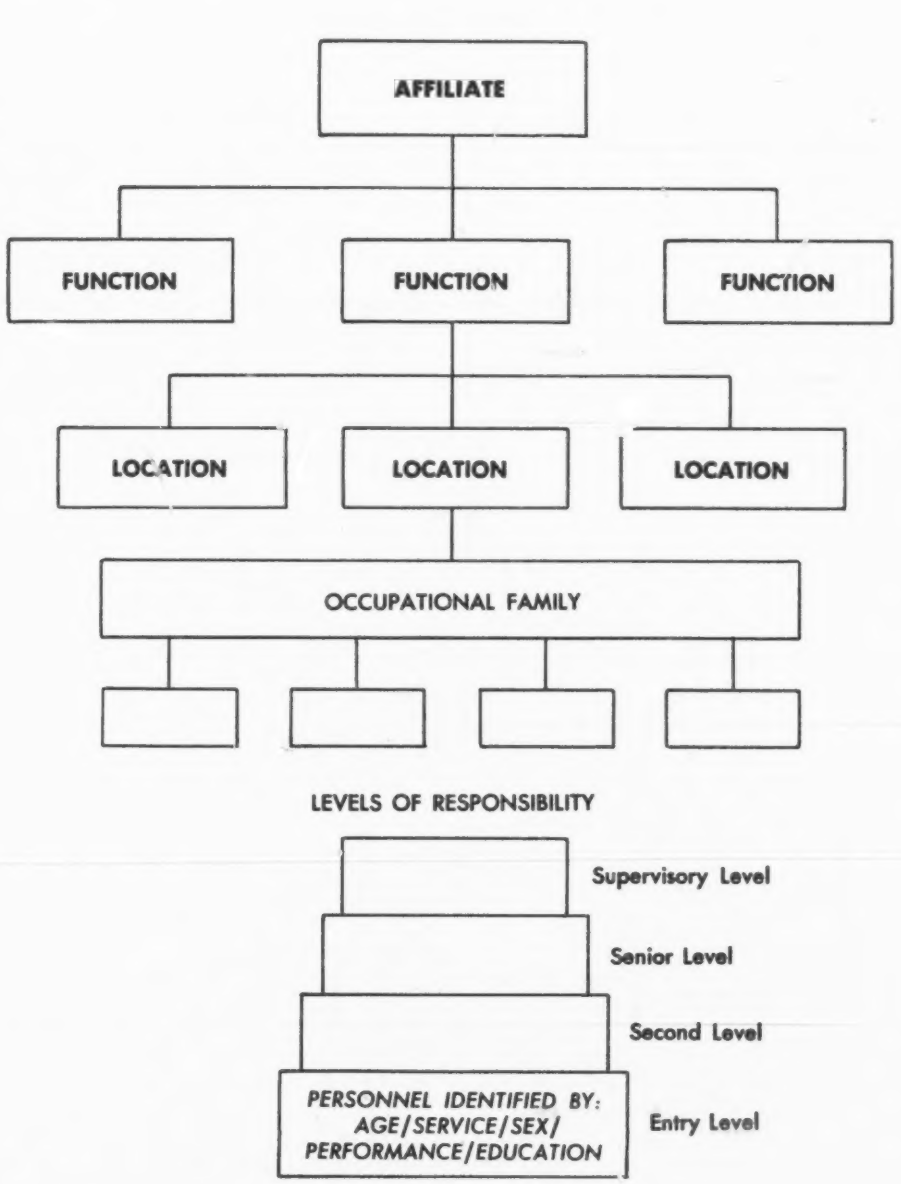
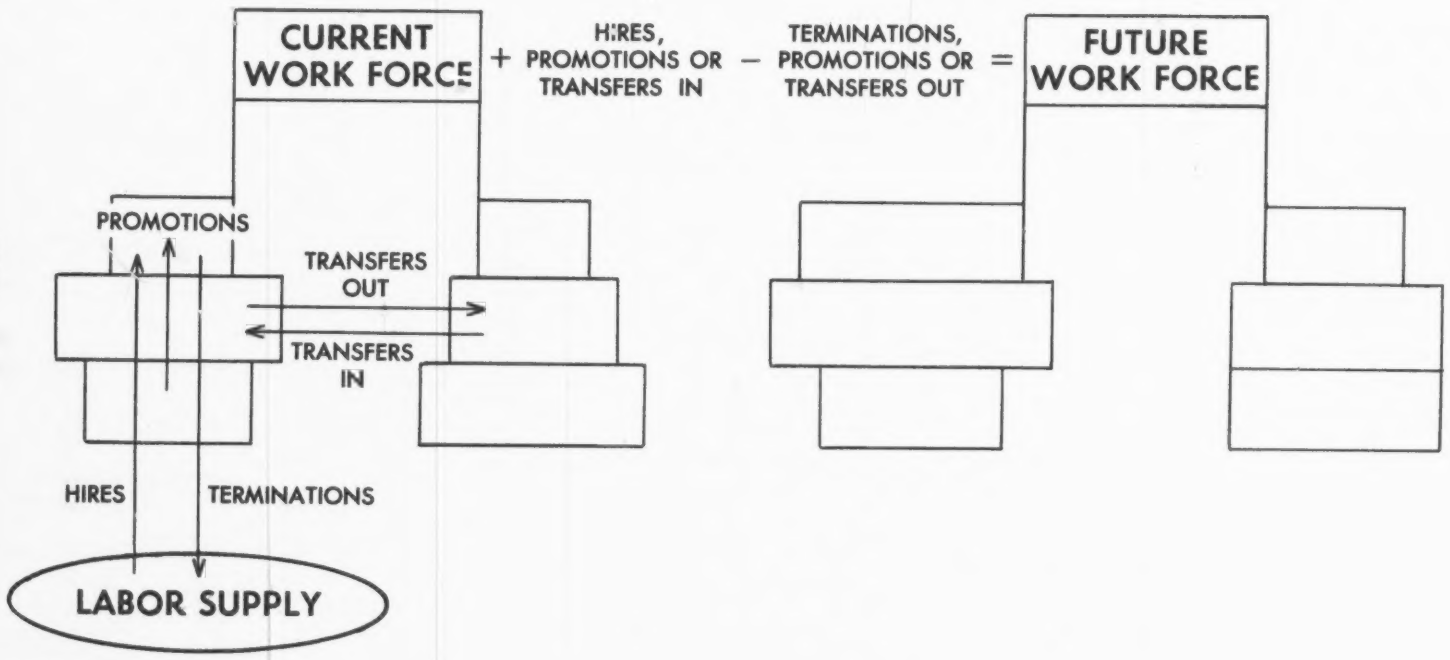


Exhibit 2

Overview of a Total Manpower Planning System



function has then been subdivided by location, and the function/location grouping further classified into occupational families, or groups of closely related occupations as determined by work content and skill requirements. Finally, each occupational family has been subdivided again into several levels of responsibility.

Under this breakdown, individual employees can be classified into appropriate job structure categories and described according to such salient personal characteristics as age/service/sex/performance/education. The resultant data, when summarized, presents a picture of the company's current manpower that interrelates types of jobs and types of people.

Using the same job structure categories, it is possible to project future manpower requirements. Once this is done, attention can be directed to one of the central issues of manpower management — the changes indicated in the numbers and types of personnel required to meet the operating needs of the future. An organization can adjust to future needs by a variety of actions, but the consequences of such actions manifest themselves in only four ways: hires, terminations, promotions and transfers. When the persons affected by these four instruments of change are described in terms of the personal characteristics noted above — age/service/sex/performance/education — we have the basic elements for a meaningful total manpower planning system. (See Exhibit 2.)

Within a total system, manpower projections are critical both in decision-making and in problem identification. Their importance to the decision-making process is fairly obvious since it is almost impossible to conceive of taking action without a clear picture of the underlying purpose. It is the problem-identifying capacities of manpower projections which are usually underestimated, because of the general assumption that projections have meaning only for the future. And who

needs to worry about tomorrow's problems when today's have not been solved?

In actual fact manpower projections deal as much with today's problems as with tomorrow's. We must count as current problems those which require action and satisfactory resolution today, even though the consequences of our inaction may not be experienced until later. Manpower projections can uncover such problems in a systematic fashion by tracing them back from their future consequences.

SOME SPECIFIC APPLICATIONS

Within the broad framework described above, there are a great many specific applications of manpower projections. A major one is their use in identifying recruiting problems, assessing recruiting priorities, and framing appropriate courses of action. By indicating both the level and type of future manpower needed in significant segments of the work force, manpower projections make it possible to relate present recruiting effort to a future need for experienced personnel rather than simply to the number of immediate vacancies. Moreover, by analyzing the trend of future company hiring needs in the context of a prospective total supply/demand situation, they provide a sound basis for deciding such questions as whether to level off the peaks and valleys of recruiting efforts or to advance or postpone part of the hiring targeted for a particular year, and thereby exploit more advantageous supply/demand conditions.

Finally, information on long-term hiring needs should help ensure sufficient lead time to frame and implement new recruiting strategies pertaining to sources of supply, the type of persons to be recruited, and effective techniques for attracting candidates.

An even more important use of manpower projections oc-

curs in connection with the design, administration, and evaluation of employee development programs, for these programs more than any other areas of manpower management stress the future. The means by which employees are selected for development, and the type of assignments given them, are now receiving considerable attention, but more emphasis needs to be placed on ensuring compatibility between the sum total of all employee development programs and the company's actual needs. Both the employee and the company will be penalized if developmental plans have to be abandoned in midstream because of a dearth of promotional opportunities, or if important jobs are improperly filled because of a lack of qualified candidates.

With the aid of sound projections of future manpower needs, developmental assignments can be directed to areas of potential talent shortage and away from areas of potential surplus. The overall pace of development can be advanced or retarded as prospective conditions require. The future effectiveness of existing practice can be tested, and fresh approaches devised, in the light of new conditions.

Manpower projections may also have a significant impact on manning levels and talent utilization. Since the elimination of manpower surplus and the correction of serious talent misutilization are among the most explosive manpower issues facing companies, it is important to identify such situations as far in advance as possible. Moreover, a company can accommodate only a limited amount of disruptive change within a given time period; consequently, an understanding of those situations in which a problem is likely to increase with time, and those where it is likely to diminish, can have a critical impact on setting priorities and deciding on specific courses of action.

It should be recognized that although the objective of every company is to have the ideal employee for every job, as a practical matter this goal can never be fully realized. Com-

panies usually are short of certain critical skills, or experience, or ability, and thus face the continuing question of how best to allocate scarce talent in light of their business objectives. The development of appropriate solutions among competing functions, affiliates, and business lines goes to the heart of each organization's vital interest; consequently, the judgments made must be well thought out, and corrective actions must take into consideration the needs of the future as well as those of the present.

Finally, it should be emphasized that the value of manpower projections does not rest exclusively upon the particular applications outlined here. The projection process itself, by forcing management to come to grips with its future manpower situation in a systematic way, can generate greater awareness of the importance of sound manpower management. In the final analysis, this may be the largest single benefit which a company realizes from manpower forecasts.

JERSEY'S OVERALL APPROACH

The ultimate objective in Jersey is to develop a fully rounded manpower projection program that ties into a comprehensive system of manpower planning and serves all the purposes described above. At present, we have traveled only part of the way to that goal.

As you may know, Jersey has shifted within the past two years to a fully decentralized corporate structure in which there are a number of highly independent regional organizations, each one responsible for oil and gas operations over a wide geographic area. In addition to Humble here in the United States, there is an Esso Europe, an Esso Inter-America, an Esso Far East, and so forth.

As the focal points of the company's operations, these regional organizations are also planning activities. Every spring

each submits to New York, through its Planning Department, a "corporate outlook" covering the region's anticipated performance year by year for the next ten or so years.

At the same time, the regions submit, through their respective Employee Relations Departments, estimates, by function (marketing, manufacturing, producing, and the like), of prospective total manpower levels and prospective managerial, professional, and technical manpower levels, covering the same period as the business projection. The year-to-year changes in MPT manpower levels are combined with projected annual MPT turnover losses from all sources to generate a figure for annual MPT hiring requirements. Such forecasts give a simple picture of the demand situation facing the organization.

On the supply side of the equation, the regional organizations indicate how they expect to meet their annual MPT hiring requirements over the forecast period—to what extent they can meet them by hiring additional university graduates, to what extent by hiring nongraduates, and what portion of the need will be met by transferring-in experienced company personnel from North America or Europe.

In their present form, the regional manpower forecasts serve three basic and useful objectives: (1) they shed light on labor costs and their probable impact on profits, (2) they outline the broad manpower implications of the company's forward business plans, and the possible constraints manpower needs may place upon the realization of these plans, and (3) they indicate to the regional organizations, which must supply experienced personnel to other regions, the magnitude of these needs down the road, so employee recruiting and related manpower plans can be adjusted accordingly.

These are all useful purposes, but the projections also need increasingly to focus on the really significant manpower issues that face the company. Much of the initiative for such an

effort must lie with the regional organizations, and we are trying to modify our reporting requirements to encourage such an approach. This, we believe, will require a substantially different reporting method, which asks for sharp analysis rather than an increased volume of raw data.

CHOOSING THE METHODOLOGY

To be more than just a numbers exercise, manpower projections must be considered reliable by those who make the decisions. This objective is more easily attained when the decision-makers have been involved in developing the projections underlying their decisions. For this reason, lodging the primary responsibility for manpower projections with the regional and operating organizations makes a good deal of sense.

Few of the regional organizations in our company had had any experience with manpower projections at the outset; therefore, headquarters assumed the responsibility of recommending a methodology. Our goal was to establish standards against which the regions could measure their efforts and to ensure some cohesiveness in the overall company approach.

Out of the wide variety of techniques for making company manpower projections, the choice of a particular one depends largely on the needs of the organization in question. In developing Jersey's methodology, for example, we took account of the fact that oil and gas operations were part of an integrated industry in which any new technology had to be linked to existing processes. This limited the degree to which new operations could depart from the old and meant that technological change within the industry could be predicted more accurately.

Also, because of the relatively high level of business certainty, our methodology had to yield accurate results. We discarded as too imprecise what might be called the industrial engineering approach. This bases calculations of future

manpower requirements mainly on the additional manpower needed to staff new projects, which, in turn, is based on an array of standards derived from existing operations.

Let me emphasize that I am not downgrading this method. In fact, a variant has been used in developing projections in chemicals and other new investment areas. If a company is undertaking a big new project involving numerous unpredictables that will greatly affect total manpower requirements, the industrial engineering approach may be just what is needed. But if future manpower changes are expected to be fairly modest, this approach does not usually yield much better results than a simple trend extrapolation.

While we felt that the impact of productivity changes upon future manpower requirements needed to be taken into account in a sophisticated fashion, we were not prepared to rely exclusively on a multiple regression technique, which would derive future manpower needs mathematically on the basis of their relationship to certain significant business factors. For one thing, not enough data were available to apply this technique properly. More important, it was much too complicated for a beginning approach. We wanted to come to grips with the critical relationship between changes in operating requirements and manpower, but we also wanted our methodology to leave plenty of scope for operating personnel to exercise their judgment. We were well aware of the pitfalls of relying too heavily on judgment, but we believed that good projection results could be obtained from the combined use of historical statistical data and judgment, if judgment were brought into play at the appropriate time. To us, the appropriate time was *after* the relevant data had been analyzed rather than *before*.

In particular, we wanted to devise a methodology that would cause management to recognize that the inexorable thrust of improved productivity causes manpower require-

ments *per unit* to decline rather than to remain stable. In our experience, managers tend to assume that reductions in unit manpower requirements stem almost exclusively from certain special factors which occupy a large portion of their time and attention. But, even after accounting for the effect of all special factors, including major engineering projects, new organizational approaches, capacity utilization, product mix, share of market, and plant size, there is nearly always an important residual productivity advance. The reason is the substantial cumulative effect of a host of individual and insignificant changes, such as minor equipment changes, installation of larger units, consolidation of certain operations, the enlargement of particular jobs, and the upgrading of the workforce. Although those introduced in the past are difficult to identify, and those of the future even more difficult to visualize, these improvements have steadily increased productivity in the past and can be expected to do so in the future.

PROJECTING TOTAL MANPOWER REQUIREMENTS

As already noted, we work with three basic tools: the business outlook, historical data, and our knowledge and understanding of the way in which business activity and manpower needs interact. Initial projections are based solely on the business plan and on historical relationships, as gleaned from available data. A separate projection of total manpower requirements is made for each of the major functions in petroleum production and marketing, and for each subfunctional activity that is unique and of sufficient size. Insofar as possible, the projections are tied to those measures of gross business activity to which manpower needs can be related in a direct and unambiguous fashion, and for which both historical and outlook data are available or can be determined.

Once the past trends in the manpower-business activity relationship (the manpower coefficient) are plotted, they are

extended to show a basic trend, which is then adjusted for changes known to be occurring in manpower relationships. As a final step, the projected manpower coefficient, or basic trend, is converted into manpower needs for each year in the projection period.

Now, with that thumbnail sketch of the procedure, let us look more closely at each step in the process:

Step 1: Select major subfunctions for which separate projections will be needed. As noted earlier, the manpower projection for a particular function is a projection of the ratio of men required per some selected measure of business activity. Within a function, however, there may be some subfunctions which do not respond in the same way to the selected factor. In producing, for example, the number of active wells was suggested as the basic factor influencing total employment. This factor applies also to certain producing subfunctions—oil field operations, for one — but not to all. Employment connected with liquefied natural gas operations, for instance, depends on independent management decisions to enter this field. And even oil field support employment (in schools, housing, recreation, etc.) depends not on the number of wells but on the location of these wells and whether community support facilities are available or must be provided by Jersey.

Thus, for an accurate projection of total employment in the producing function, each production subfunction must be examined separately to see which warrants a separate projection of its manpower needs. A decision for special handling would depend primarily upon two factors: (1) the nature of the subfunction must be different from the main functional activity, and it must respond independently to business decisions; (2) the subfunction must involve a large number of employees.

Step 2: Select an appropriate business factor. The second step in projecting total manpower requirements is the selec-

tion of the business factor most closely related to the manpower needs of a particular function. There are several criteria that must be applied:

There must be good reason to believe that changes in the selected business factor will be proportional to changes in its associated manpower. For example, we might consider using a projection of product volume sold to indicate the number of sales personnel required. But if the volume per customer is likely to change significantly, then total product volume is probably not as good a measure of sales employment as the projected number of customers. (This figure, in turn, may be derived from product volume projections by using available data or assumptions about volume per customer.)

Historical data pertaining to the selected factor must be available. It must also be possible to obtain, either directly or by inference, a projection of the factor from the long-range corporate outlook or a similar document.

There must be a good historical correlation between the factor and total manpower needs. In producing, for example, discussions with operating management led to the hypothesis that the number of active wells was the basic determinant of manpower requirements. This hypothesis was supported when analysis of historical trends revealed a good correlation between the changes in the number of wells and manpower.

Step 3: Determine historical and projected levels of the selected business factor. In many cases, historical data for the selected business factor are reported in a slightly different form from what is required and have to be adjusted. For example, in projecting total road vehicle employment within marketing, it may be necessary to subdivide total liquids volume sold into two categories — that distributed to bulk customers and that

distributed to nonbulk customers — because road vehicle employment is most directly related to nonbulk, or truck-delivered, products.

In other instances, the selected business factor may not be forecast in the business outlook, but has to be calculated from other measures that are included. For example, for the producing function, it is necessary to correct the projection of gross liquids production reported in the corporate outlook into a projection of the number of active wells. This can be done only on the basis of the judgment of functional personnel as to probable average production per well.

Step 4: Determine historical manpower levels. The manpower data used for the historical analysis must be related directly, of course, to the business activity to be projected. In developing these data we have encountered such problems as these:

> Manpower data usually are not reported in detail; consequently manpower levels have to be estimated from whatever data are available. For example, petroleum specialties employment data may not have been kept separate from fuel products refining data; thus, this employment has to be calculated from total refining employment on the basis of petroleum specialties product volume or gross fixed assets data, which are available on a historical basis.
>
> Contract labor may have been used. If so, it is necessary to add contract men to employment in order to obtain a realistic manning figure.

Step 5: Plot the historical manpower coefficient and project for forecast years. The manpower coefficient is simply the ratio of total manpower to the business factor. In producing, this ratio has been expressed in terms of total active wells per man. The initial projection of the manpower coefficient should be based upon a straightforward extrapolation of its historical

trend, as determined by the most appropriate measure of "best fit".

Step 6: Adjust for the influence of special factors. In basing the projected manpower coefficient on an extrapolation of historical trends, we are assuming that the rate of change in the coefficient will be the same in the future as it was in the past. This of course is not necessarily true. As mentioned previously, we are aware of two types of forces influencing the rate of change in the manpower coefficient.

Glacial factors, such as minor equipment changes, labor-saving devices, and job enlargement. While individually insignificant, these factors have a substantial collective impact on manpower needs.

Special factors, such as significant innovations, changes in capacity utilization, or major organizational changes, all of which have a more tangible but less consistent influence on staffing trends.

The influence of both sets of factors upon the rate of change in the manpower coefficient may be different in the future than in the past. The changes occasioned by special factors, however, are likely to be more important, and their effect upon manpower requirements can be more reliably measured. The measurement process must take into account both the major developments anticipated for the forecast period that did not occur in the historical period, and the impact of major developments that occurred in the historical period but are not expected to recur during the forecast period.

The purpose here is to determine the degree to which special factors will influence manpower differently in the future than in the past, rather than their total effect on manpower. If, for example, prospective business plans call for the large-scale introduction of automation in producing operations during the forecast period, the first step would be to translate the best estimate of the impact of the program into terms of

men per active well. This estimate would then have to be discounted to the extent that the automation factor influenced manpower in the historical period. Similar adjustments would be made to account for other special factors. Finally, the initial projection of the manpower coefficients, based on the extrapolation of trends, would be adjusted accordingly.

This whole process of adjusting for the influence of special factors clearly involves the exercise of considerable informed judgment. It can best be handled by operating personnel who have an intimate understanding of both past developments and prospective plans.

Step 7: Convert to a projection of employment. The next step is to convert the projected manpower coefficient to a projection of total manpower. This is a simple step in which the number of men required for each unit of the business factor is multiplied by the projected number of business factor units, based on the corporate outlook. If contract labor has been included, it should be subtracted at this point so that the result is a projection of permanent employees required. If the manpower needs of several subfunctions have been projected separately, they should be added together in this step to indicate the total number of employees required within the region to man the major petroleum function under analysis.

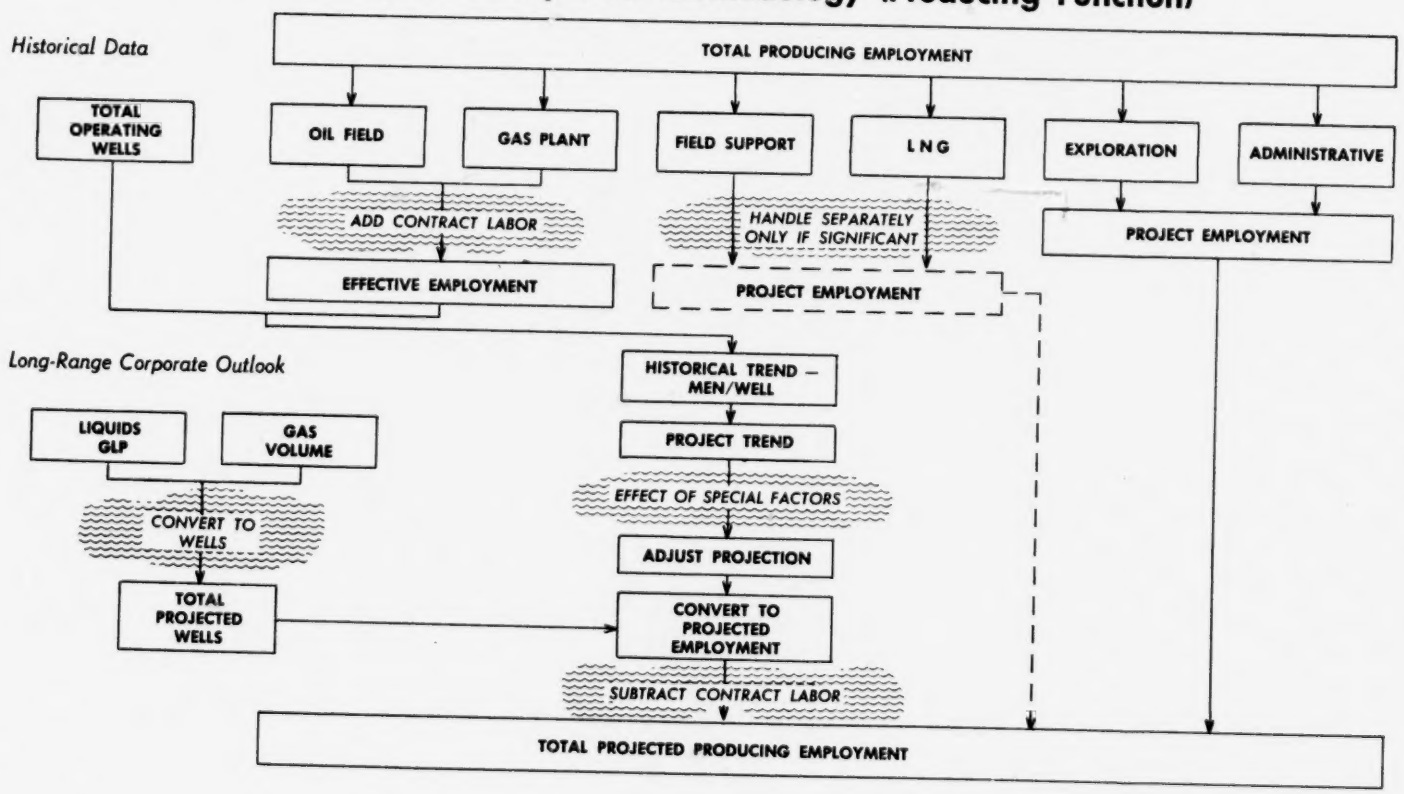
The various steps which I have outlined for projecting total manpower levels are summarized by the flow chart shown in Exhibit 3.

PROJECTING MPT MANPOWER

The projected total manpower level for each function serves as a basis for the forecast of future managerial, professional, and technical (MPT) manpower levels. Jersey's planning effort places emphasis on this group of employees for three basic reasons:

Exhibit 3

Total Manpower Projection Methodology (Producing Function)



First, the company has a very substantial per capita investment in its MPT staff, and a sizable part of this outlay is geared to long-term results rather than to immediate payout.

Second, because of the nature of most MPT jobs, the quality of individual performance may vary widely, and the company's effectiveness in maximizing performance can have a very substantial impact upon the utilization of all its resources — capital and material, as well as manpower.

Third, the MPT group represents the growth segment of the company work force, and it is for this group that the competition for top talent from universities, government, and other companies is most severe. Thus, if the company is faced with any serious manpower imbalances they are most likely to show up in the MPT area.

In selecting an appropriate methodology for projecting MPT requirements, it must be recognized that one of the most pervasive trends of the past twenty years has been a rise in the ratio of MPT to total employment, which can be expected to continue (see Exhibit 4). This trend is observable, although in different degrees, for the U.S. economy as a whole and in almost every U.S. company for which data are available, regardless of whether their total manpower levels are rising or falling. The growing relative importance of MPT manpower also appears to pervade the whole Jersey company, regardless of the locations or the functions involved. There has been almost uninterrupted growth in the MPT ratio over the past decade in Canadian producing operations, Canadian marketing operations, and U.S. refining operations. Illustrations from other regions or functions would show the same trend.

There are two main reasons for the steady growth in the ratio of MPT to total employment. The major one is the shift in company job requirements stemming from the increasing sophistication of management, the growing complexity of op-

Exhibit 4

Distribution of U.S. Manufacturing Employment by Broad Occupational Grouping

	Manpower Classification	Actual 1966	Projected 1975	Average Annual Growth Rate
1.	Professional and Technical	9.1%	11.2%	2.3%
2.	Managers and Proprietors	6.0	6.3	0.5
3.	Sales Workers	2.5	3.6	4.1
	Total "MPT"	17.6%	21.1%	2.0%
4.	Clerical	12.2	12.2	..
5.	Craftsmen and Foremen	18.4	19.3	..
6.	Operatives	46.4	43.6	..
7.	Laborers	5.4	3.8	..
	Total Non-"MPT"	82.4%	78.9%	..
	Total	100.00%	100.00%	..

Source: U.S. Department of Labor, Bureau of Labor Statistics

erations, and the introduction of new methods and technologies. We find, for example, a need for systems men instead of payroll clerks, financial analysts instead of statistical clerks, engineers instead of mechanics, electronics experts instead of semiskilled operators.

Part of the higher ratio of MPT jobs to total employment, however, is the reciprocal action of the decline in wage and clerical-type jobs and does not reflect any change in MPT requirements. Such a situation is well illustrated by the transition in refining to the use of multiskilled mechanics. Here more efficient utilization of the mechanical force has permitted the company to do the same work with far fewer mechanics and, while the MPT ratio increased, the need for MPT jobs was not affected.

The Methodology

The underlying reasons for the higher ratio of MPT to total employment had an important bearing on the methodology chosen for projecting MPT employment levels. Two basic alternatives were considered. The first was to derive an MPT manpower coefficient in much the same way as the total manpower coefficient was developed. If changes in MPT job requirements are largely independent of changes in non-MPT job requirements, the MPT manpower coefficient will provide a clear measure of changes in the efficient use of MPT personnel. However, if these changes are interrelated, the MPT manpower coefficient is really measuring the combined impact of total manpower efficiency (which we have already measured) and changes in the MPT ratio.

The second alternative was simply to project the ratio of MPT to total employment and then to multiply this ratio by the projection of total manpower requirements, to derive an actual MPT number. In those situations in which changes in MPT job requirements are closely related to the changes in non-MPT job requirements, we could safely use the MPT ratio approach and take advantage of its greater precision.

In testing the two approaches in various situations, more consistent results were attained by using the MPT ratio approach. This method also made the job a good deal simpler because we could utilize directly many of the judgments on special business factors already made in developing the total manpower projections. Use of the coefficient approach would have made it necessary to duplicate the process. In view of the amount of time and effort required to develop manpower projections, the time-saving possibility was of considerable importance.

Regardless of the method finally selected for projection purposes, the remaining approach can be used to test and

cross-check the final results. In order to simplify today's discussion, we will talk in terms of the MPT ratio method. However, the basic methodology outlined, with a few minor arithmetic adjustments, is equally applicable to the MPT coefficient approach.

The Projection Procedure

We have already covered much of the basic MPT projection procedure in our earlier discussion of total employment projections. The important subfunctions within each major function have been analyzed. The major business factors within subfunctions and their appropriateness to manpower projections have been examined. And we have looked at the special factors which may change established manpower relationships. Our procedure now is to reexamine each of these elements specifically in light of the outlook for MPT personnel.

At the outset, we must make sure (1) that the need for personnel responds to the same basic business factors as total manpower, and (2) that the special factor adjustments used to modify the total manpower coefficient data apply in the same fashion to MPT manpower.

The first assumption is in most cases likely to be true—the second assumption, however, may often be wrong. Thus, the MPT projection procedure, when it is based on the total employment projection, must include careful examination of these assumptions on a function-by-function basis.

Finally, we must be on the lookout for additional special factors which have a substantial influence upon MPT manpower projections, even though they may not have had a significant impact upon total manpower requirements.

Now, let us quickly review the basic procedure used to project MPT manpower in producing operations.

Step 1: Analyze major subfunctions. The first step is to consider each of the subfunctions identified during the projection of total manpower requirements and to determine where MPT projections for individual subfunctions appear necessary. Where special handling is required, as with LNG plants and exploration activity, separate MPT projections will have to be developed.

Step 2: Plot the historical MPT/total manpower ratio, and project for forecast years. Past trends in the MPT/total manpower ratio have to be determined. In plotting these trends, it is generally necessary to use data that include contract labor, since Jersey MPT employees are utilized as supervisors of contract as well as regular non-MPT Jersey employees. Moreover, any MPT jobs that were subcontracted should be added to the historical MPT manpower data. With these adjustments, the MPT/total manpower ratio can be projected to the forecast year.

Step 3: Adjust for the influence of special factors. All factors possibly influencing the MPT/total manpower ratio must be considered. As with our analysis of total employment manpower coefficient trends, it is necessary to keep in mind only those factors which cause the ratio to change. For example, office automation and data processing have been introduced at a reasonable rate over the past 10 years and can be expected to continue to be introduced at somewhat the same rate during the next 10 years. Further, if we assume that these procedures reduce the number of clerical persons required and increase the requirements for MPT people — programmers, engineers, etc.—then certainly this factor continues to influence the MPT/total employee ratio. However, since the influence of this factor is fully recognized in the historical trend we have plotted, the trend projection assumes the factor will continue to have the same influence.

Those special factors which have had about the same in-

fluence on MPT employment as on total employment will not change the basic ratio, of course. Off-shore oil production, for example, will require both more non-MPT as well as more MPT persons per completion than similar land-based facilities, but the relationship between the two is not likely to change.

Step 4: Convert to a projection of MPT employment. Finally, the adjusted projection of the MPT-to-total employment ratio must be converted to a projection of MPT manpower. This is done by multiplying the ratio by total projected employments. To the extent that MPT contract labor may be used, it must be subtracted to provide a projection of the total number of Jersey MPT employees required.

The projections generated by the regional and operating organizations do not break down future manpower requirements but report overall MPT levels. However, we have done some work on a methodology for projecting needs by job families and by levels of responsibility, using much the same approach as that outlined for the derivation of MPT levels from total manpower levels.

Step 5: Take account of turnover losses. The final step in the projection methodology is to combine anticipated changes in MPT manpower levels with estimated turnover losses to derive annual MPT requirements. A detailed discussion of techniques for projecting turnover losses is not necessary here, but two simple points should be made:

First, for a great many companies turnover losses are likely to have a far greater impact upon hiring requirements than an increase in jobs. Thus, accurate projections of potential turnover losses are critically important. Remember that the difference between annual turnover rates of 4 percent and 5 percent per year, which may appear small, is actually a 25 percent variation.

Second, turnover experience must be broken down by job structure categories—functions, occupational families, and the

like—and by personal characteristics—sex, performance, and educational background. These breakdowns are necessary both to ensure reasonably accurate projections of total turnover losses and to provide better insight into their nature and locus. The calculations are not particularly difficult to make, but many companies, because of lack of data, cannot yet undertake them.

RELIABILITY OF MANPOWER PROJECTIONS

While it would be tidy to end the discussion at this point, the question of the accuracy and reliability of projections of future manpower requirements has to be faced. At some point the forecaster must be held accountable for his results; if he is not, performance is not likely to improve substantially.

Jersey's manpower projection program has not been in effect long enough for meaningful conclusions to be drawn. If the manpower projections follow the pattern established in projections of other business factors, we can expect a significant variation between forecast and actual results. However, though the projections may be technically inaccurate, they still may be sufficiently reliable to identify a serious problem. In other cases where they are off, the results will still be a better guide than the traditional "guesstimates."

In short, the degree of inaccuracy in the projections is basically a function of the ways in which the projections are used. One way to ensure greater accuracy is to make sure the projections are used properly. In the first place, the sensitivity of the projection results should be determined; that is, do small changes in some of the assumptions cause major changes in the resultant numbers? Wherever possible, a careful assessment of reliability should be made in terms of the specific problems at hand. The advantages of action versus inaction should be carefully weighed.

Despite the implication of my earlier statement that an inaccurate projection may be better than none at all, I do think it important to test actual results against the projected results. However, to make any sense out of this process it must be possible to determine the proximate cause for any variation. It makes a great deal of difference whether it resulted from modification of business plans, the influence of some special factor, an error in the productivity assumptions, or a poor turnover estimate. Once the forecasting results have been evaluated in this way over a period of time, corrective actions can be initiated.

Despite the precautions taken, there remains an element of risk involved in using projections. But the counterpart of risk is reward.

Accommodating Short-Term Fluctuations to Long-Term Manpower Planning

JOSEPH B. MUNRO, JR.

Management Relations Administrator, Quincy Division, General Dynamics Corporation. Mr. Munro joined the Electric Boat Division of General Dynamics in 1956. He served in a variety of technical positions before being transferred to the industrial relations staff in 1962, as salary administrator. Moving later to the corporate staff, he was responsible for recruiting, manpower planning, and training. At present he is in charge of professional and technical recruiting, wage and salary administration, and manpower planning in the engineering department of the Quincy Division. Mr. Munro is a graduate of Brown University (B.S., Physics, 1952) and the University of Rhode Island (M.S., Industrial Management, 1960).

Accommodating Short-Term Fluctuations to Long-Term Manpower Planning

JOSEPH B. MUNRO, JR.

If five industrial managers were asked to define "manpower planning," they probably would respond in five widely different ways, for two main reasons:

The activity known as "manpower planning" is new in industry,

The particulars of any given program are determined to a large extent by the specific business needs of the company, and by the whims and personalities of people within the company.

At General Dynamics, manpower planning has been an element of divisional operations for some time, but a companywide program was initiated only a short time ago when

(c) 1964

corporate headquarters began to receive conflicting reports explaining schedule slippages. Within the same division, some managers blamed these failures on manpower shortages, while others denied that this was the reason. Deciding to review manpower planning in all the divisions, corporate headquarters asked each division to report (1) how many personnel requisitions were open, (2) how long the requisitions had been open, and (3) how many employees had been hired within the past few months.

The survey revealed some significant information—largely on immediate needs — but it did not offer any long-range planning information and therefore left a great many questions unanswered. As a result, we set out to design a plan that would provide the needed facts. Our view of manpower planning, as embodied in this plan, focused on delineating the total manpower requirements of the future — five years, ten years, or fifteen years ahead. By "total needs" we meant all personnel to be acquired; all terminations and layoffs; all training activities; and all transfers, loanees, and contract labor;[1] also all overtime, absenteeism, and tardiness. As we saw it, manpower planning included not only consideration of external labor markets and their potential labor yields, but also alternative costs of different approaches to meeting manpower needs — a factor too often overlooked. In short, we sought to encompass in our planning all factors affecting manpower levels and the company's ability to acquire the skilled people it needed. This total task we saw as being divided into three phases:

Phase One: Operational planning, or the pin-point planning directed to acquiring skills needed during the next three months

[1]Personnel whose services are purchased on an hourly basis from a firm which offers temporary help. Also known as "job shoppers."

Phase Two: Intermediate planning, or a one-year forecast, updated each quarter

Phase Three: A long-range forecast, covering at least five years.

The three phases, as outlined above, overlap one another and range from the specific to the general, the detailed to the less detailed. It is this variance which is the crux of General Dynamics' approach to manpower planning.

OPERATIONAL PLANNING, OR CRITICAL SKILLS REPORTING

The critical skills reporting system grew directly out of the emergency encountered when one of our divisions contracted for a substantial amount of numerical control machine shop equipment. This equipment was ordered in 1965, and although it takes considerable time to deliver and set up, it was not until the spring of 1967, within two months of the delivery date, that Personnel learned that the equipment was expected and that from 15 to 20 N/C programmers would be needed. Those familiar with N/C programmers will recognize the difficulties inherent in this request. Not only are they scarce, high-priced people and therefore not quickly found, but a long training period is usually required. Thus, the division was faced with the arrival of millions of dollars worth of machinery and no one to operate it.

The only solution at this stage was to hire job shoppers, or short-term contract labor. This was a course taken with reluctance, for, to us, reliance on job shoppers means that the planning job has not been done properly. Not only are job shoppers expensive but they create morale problems among regular employees. Most important, regular utilization of job shoppers substitutes too easily for effective manpower planning.

Under the circumstances, the best alternative was to use job shoppers until such time as we could recruit and train our own people. However, as a safeguard against future emergencies, we decided to require each of the divisions to submit a regular report (every two weeks) to headquarters indicating the division's current critical skills. A "critical skill" was defined as any skill to which one or more of the following conditions pertained:

Excessive overtime (10 percent or more) was being worked,

Failure to fulfill recruiting goals would cause schedule slippages,

Contract labor or job shoppers would have to be employed.

Within a year after the system was initiated, we began to see results. The number of job shoppers, which was 532 in 1967, dropped to 134 in 1968; critical jobs decreased from 61 to 12; and overtime was reduced from 16 to 7 percent — changes which, in total, represented savings of roughly $300,000 per month. In addition, no division blamed manpower shortages for schedule slippages.

How the System Works

The critical skills report is simply the first part, the operational or short-range phase, of our manpower planning — a device used to keep the divisions on top of their immediate manpower problems. The report is required only when the division is confronted with critical skills; thus, reporting is placed on an exception basis and is self-eliminating as a division learns to do better planning and to gain sufficient lead time for taking action.

The critical skills report also enables headquarters to keep on top of division operations. Data reported is used by the

vice president of industrial relations in the biweekly staff meeting with the chairman of the board, thereby providing information on current manpower status. On the basis of the reports, we make telephone calls, visits to divisions, and inquiries as to trends to find out why the statistics are as they are. Most important, the follow-up is used to assist the division in eliminating its particular manpower problems and, in so doing, to improve the planning job.

If a division reports no critical skills and yet later indicates that schedules are being missed because of manpower shortages, its planning comes under severe scrutiny. Or, if a division reports the same critical skills for several months or more (the length of time depends upon the situation), its recruiting and training goals and practices are examined to determine why these skill shortages are continuing.

Sometimes a division persistently reports critical skills which do not fit the critical skills criteria, evidently as a hedge against their becoming critical in the future. In such cases the corporate office recommends that the skill be dropped from the critical list, thereby forcing the division to decide on, and commit itself to, a firm plan for solving the problem.

How the Report Is Used

Exhibit 1 shows the format of the critical skills report. Using this form, each division submits the following information every other week:

Column 1 — Classification (list of critical skills in the division)

Column 2 — Present population (permanent employees), by skill

Column 3 — Number of job shoppers (contract labor), by skill

Exhibit 1

Critical Skills Biweekly Report

_____
Division

	Critical Skill Classification*	Present Population	Current Contract Personnel	Equivalent Man-weeks of Overtime (Prior Month)	Forecast Population Requirement (3 Months)	Monthly Population Goals 1	2	3	Attrition (Last Month)
A.									

B. What plans do you have for attaining monthly goals?

C. What will be the effect on production schedules and profit goals if monthly recruiting goals are missed?

_____ Prepared by _____ Date _____ I. R. Director

*In Item A, first list previously identified critical skills, then list new critical skills, identifying them with the prefix (N).

Column 4 — Average weekly overtime, expressed in equivalent man-weeks.

Column 5 — Three-month advance forecast of population requirement for each skill

Column 6 — Monthly population goals for a period of three months. (Note that we use population, not recruiting, goals. The reason is the effect that attrition, absenteeism, overtime, and many other factors may have on recruiting goals. By asking for population, we obtain a clear-cut standard of the numbers needed, based on a 40-hour week.)

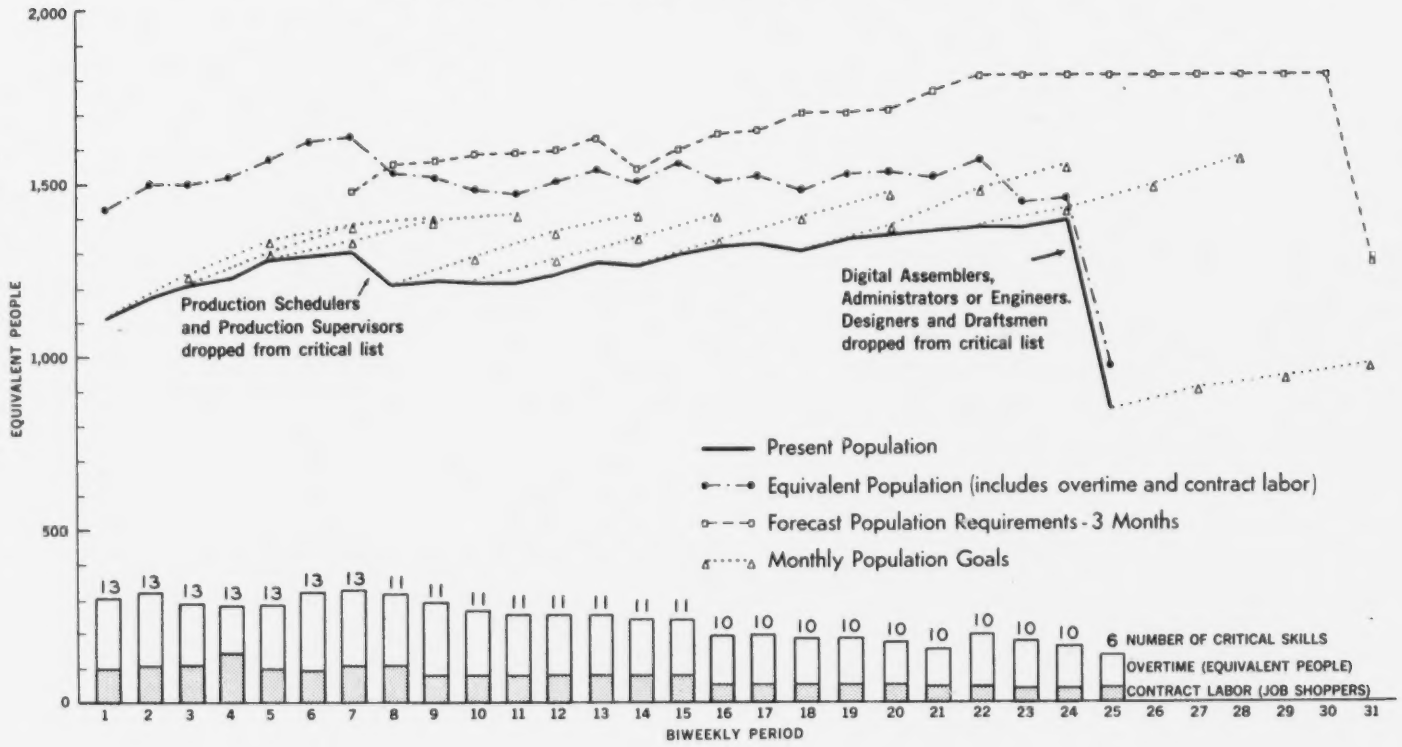
Column 7 — Attrition in each skill during the past month.

This information is reviewed every two weeks and then posted in graph form (Exhibit 2) so as to indentify any long-term trends. In the graph shown, which represents actual data reported by one of our divisions, the coordinates are number of men (vertical axis) and time (horizontal axis). Although each skill is designated separately on the critical skills report and can be investigated separately, for our purposes here we deal with the total population in all critical skill categories. These data, as plotted at a specified date, are shown by the solid line. The dotted line above indicates the total equivalent personnel. Thus, if there are 200 permanent employees in critical skill categories, 10 job shoppers, and the overtime worked is equivalent to the full-time hours of 40 regular employees, the equivalent personnel line would be plotted to represent 200 + 10 + 40, or 250. Of course, this is not a completely accurate number, since it does not take account of absenteeism and tardiness, both of which affect the total population figure; we justify excluding these factors because we are interested in trends, rather than pinpoint accuracy.

Along the bottom of the Exhibit is a bar chart representing the number of job shoppers (the dark bar) and the

Exhibit 2

Critical Skills Trends
Based on Data Reported by One Division


2,000
1,500
1,000
500
0
EQUIVALENT PEOPLE
Production Schedulers and Production Supervisors dropped from critical list
Digital Assemblers, Administrators or Engineers. Designers and Draftsmen dropped from critical list
Present Population
Equivalent Population (includes overtime and contract labor)
Forecast Population Requirements - 3 Months
Monthly Population Goals
13 13 13 13 13 13 13 11 11 11 11 11 11 11 10 10 10 10 10 10 10 10 10
6 NUMBER OF CRITICAL SKILLS
OVERTIME (EQUIVALENT PEOPLE)
CONTRACT LABOR (JOB SHOPPERS)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
BIWEEKLY PERIOD

equivalent man-weeks of overtime (the light bar). The numbers shown at the top of the bars indicate the number of critical skills listed. Attrition may be shown in bar chart form also but is not indicated here since it is small and without significant variation.

In addition to the biweekly critical skills report, we have a 3-month population forecast and monthly population goals. Thus, we show also what the division has forecast as its population requirements in three months, as well as the goals it has set to meet its forecast requirements. On this graph we can see the 3-month population forecast is considerably higher than the population goal, indicating that the division does not intend to staff fully, but plans to make up the difference through overtime and probably job shoppers. In this particular case, there are certain reasons the division has been permitted to maintain a higher population forecast than population goal.

In looking at Exhibit 2, we note two rather radical drops, one in April and one in the preceding August or September. One is caused by dropping Production Schedulers and Production Supervisors from the critical list when the division met its population goals. It fulfilled these requirements and therefore does not have to report these critical skills.

Theoretically, elimination by a division of all of its critical skills will produce a saw-toothed chart that eventually approaches zero. At this point, the division no longer has to report every two weeks.

Reporting only on the exception has proved an incentive to most divisions, since it is considered a real achievement to eliminate any report to the New York office.

From examination of the equivalent personnel line, it is possible to make several judgments. The best situation would be for equivalent skills and population to fall close together. But if equivalent manpower in critical skills categories is above

the forecast line, there are problems. One possibility, of course, is that the forecast is inaccurate. However, it is possible also that too much overtime is being worked or, if job shoppers are being used, that they are not needed. On the other hand, if the equivalent manpower falls below the forecast line, this may indicate that the forecast is too optimistic, that not enough overtime is being worked, or that there are simply not enough people available to meet schedules.

These are only a few of the many aspects of manpower planning which may be revealed by carefully studying and plotting critical skills data.

THE ONE-YEAR FORECAST

In addition to the biweekly critical skills report, we use a quarterly report which forecasts, for the following year, divisional requirements in five basic categories: (1) engineers and scientists, (2) other salaried people, (3) draftsmen and technicians, (4) skilled hourly employees, and (5) other hourly employees. (See Exhibit 3.)

In format, this forecast is very similar to the critical skills report, the main difference being that the divisions are asked to report where they think critical skills will emerge in the future. Then they are asked how the division (or department) is planning to avoid these skill shortages—what plans of action they have.

The main purpose here is to train the divisions to define their needs, and to look ahead. The principle underlying this approach is that if a division can foresee and identify a potentially critical skill, it can be expected to overcome the problem and, therefore, the critical skill will never actually appear on the critical skills list. On the other hand, if a critical skill has never been identified but appears on the division's critical skills list, headquarters is justified in investigating, and by so

Exhibit 3

One-Year Forecast of Critical Skills

Critical Skill Category	Present Population	Current Contract Personnel	Equivalent Man-months of Overtime (Last Quarter)	Forecast Population Requirement (One Year)	Quarter Population Goals 1 2 3 4	Attrition (Last Quarter)
A. Engineering and Scientific						
Other Salaried						
Draftsmen and Technicians						
Skilled Hourly						
Other Hourly						
Total						

B. Do you anticipate any additional critical skills during the next 12 months? If so, in what classifications?

C. What plans do you have for avoiding the development of critical skills?

I. R. Director _____ Date _____ Division General Manager _____

doing it probably can help to eliminate such emergencies in the future.

The one-year forecast gives us an additional input for the corporation as a whole on total population by major classification. It also establishes a basis for comparing overall statistics between divisions, but most important of all, it is a planning tool that helps bridge the gap between day-to-day operational planning and the more indefinite goals of long-range planning. A 12-month period is of sufficient duration to encompass most of the significant developments that will affect manpower planning:

Most of the radical swings in contract requirements will occur during the next 12 months.

Most long-lead personnel can be obtained in the next 12 months.

Most schedule slippages due to manpower shortages will occur during the next 12 months.

Most of the costly personnel activities that result in reduced profits can be controlled in the next 12 months.

ROLE OF THE INDUSTRIAL RELATIONS AREA REPRESENTATIVE

One of the values of the critical skills report at the division level is that it forces manpower planners to get out in the field to specifically discuss the day-to-day, week-to-week needs of a given line department. We have found that communications regarding the whole area of critical skills planning frequently are lacking, and that a great deal of precise manpower planning can be accomplished simply by communicating. All of us are familiar with the line manager who rushes in on Friday afternoon and says, "I need 200 men by Monday morning." To avoid this, we rely on the critical skills report and on the Industrial Relations Area Representative.

In many of our divisions the Industrial Relations Area Representative is stationed in the line department. His job is to know the causes and sources of schedule changes and manning variations for his assigned group of departments and to maintain liaison and continuous communication with these sources, in order to be able to assist his departments in their planning. He must be knowledgeable about present and future events affecting manpower, and he must know the factors, time elements, and costs involved in acquiring personnel. In short, the area representative is the front line of the Industrial Relations Department. And a competent action-oriented representative greatly enhances the development of a strong healthy industrial relations image.

PRECISION IN MANPOWER PLANNING

Planning for acquiring people, as for acquiring material, needs to be geared to the long-lead items. Any planning that provides adequately for obtaining hard-to-get personnel will probably ensure fulfillment of total personnel commitments. How to plan is explained in many texts, but in my opinion the manpower planner, the Industrial Relations Area Representative, or the recruiter often falls short because he does not base his planning on long-lead personnel needs. "Let's get them everything as fast as we can" is the usual approach.

In General Dynamics we encounter another complicating factor in manpower planning which may stem partly from the precision required in manufacturing such products as atomic-powered submarines, electronic equipment, etc. Our managers are mainly technical people, and they try to make manpower forecasting as precise as the product they manufacture. Frequently I hear: "That's my best estimate now, but don't hold me to it." These words may very well hold the key to better manpower planning and control.

Let me explain. In the process of hiring a long-lead individual, there are certain known elements which we can predict and plan for. For example, we know:

That the candidate must be hired by a certain date

That approximately one week will elapse from the date our offer is made to the date of his acceptance

That he must generally give a two-week notice of termination to his present employer

That it will take him approximately one week to travel from his current location to our division.

All of these are factors more under the control of the individual than under the control of the company, and once the company has made an offer it is committed to a period which it cannot compress or expand. Prior to the date of offer, however, there is a period of flexibility which can be varied from one month to as long as perhaps nine months, depending upon the concentration of the recruiting process. This process begins with the date it is first decided that manpower is needed, and it extends through the recruiting and interviewing stage — up to the time an official offer is made.

For effective manpower planning, it is necessary to know the time spans and ratio of offers to acceptances for each key event, such as advertising responses, applications, interviews and offers. Armed with this information — assuming it is updated and monitored during the recruiting process — the manpower planner can constructively discuss with the operating departments the projected success of their meeting given manpower goals. He can also discuss appropriate modifications, if these are necessary as a result of contract and schedule delays and speedups. By adjusting the company-controlled phases of the acquisitions cycle as special circumstances demand, the manpower planner may be able to work

more effectively with the manager who says, "That's my best estimate . . . but don't hold me to it."

Although I have spoken mainly in terms of the hiring process, the use of all the tools for acquiring personnel — upgrading, training, transfers, referrals, loans — will, if judiciously blended, produce a personnel acquisition effort almost perfectly responsive to the needs of a given division.

THE LONG-RANGE PLAN

We are still working to develop an adequate long-range manpower plan. In 1967, for the first time, a large portion of the corporate five-year financial plan was devoted to manpower planning. The information requested was in terms of numbers of people. How many will the division need? How many will quit? How many engineers will be hired directly out of college? How many experienced engineers are needed? What new skills will be required? In 1968, in an attempt to direct division management to better manpower planning, we included costs.

> Where we asked for turnover statistics (the costs of hiring and training to bring the learning curve to a productive level), we asked also for the costs of turnover.
>
> Where we asked for manpower sources, we asked for costs of training local, less skilled hires.
>
> Where we asked for skills mix, we asked for projected payroll dollars.

This was done to provide division management with the basic information needed for planning; it was hoped that the divisions would weigh such pros and cons as the following:

> Is it more economical to hire large numbers indiscriminately, risking high turnover, or to spend more time and money in screening applicants, with a probability of lower turnover?

Is it more economical to hire and train lesser skilled local people, or hire more distantly located but better qualified applicants, and move them?

Is it more economical to enter the highly competitive and expensive national engineering market, or to utilize technicians and associate degree engineers, changing job structures when necessary?

These are a few of the trade-off decisions that have to be made by management. We also expect manpower planning factors to influence major decision-making in broader corporate planning. For example: How large can a particular division grow in a specific geographical area? Economically, how many employees can an area support? Such questions are considered in setting up new plant operations, as well as in operating existing plants.

Since communication plays a major role in our approach to manpower planning, I would like to conclude with some observations by Algie A. Hendrix, vice president of industrial relations for General Dynamics, pertaining to the development of stronger interfaces between line and staff activities in industrial relations, including those of manpower planning.[2]

1. Day-to-day relationships between Industrial Relations and the organization manager are strongly influenced by mutual interest or lack of same for each other's problems.

2. Fundamentally, it is the responsibility of Industrial Relations to earn acceptance from the organization manager.

3. A proper relationship cannot exist if the organization manager only wants Industrial Relations to clean up the mess after the organization manager has taken independent action.

4. Conversely, when Industrial Relations takes the responsibility and authority for decision-making from the organization manager, inefficiencies and clashes are sure to eventually develop.

[2]"Industrial Relations—Responsibilities and Opportunities", a speech before The Department of The Navy, Industrial Relations Institute, Washington, D.C., October 11, 1963.

I believe Robert Sampson, in one of his books, made an excellent analysis in what he calls "if-then-the-ideal situation."

—"If the manager is faced with a problem,

— If the industrial relations man has established himself as a source of help to the manager,

— If the manager realizes fully that they are to decide what to do,

— If the industrial relations man respects the ideas and capacities of the manager,

Then an analysis can be made of the problem (using the capacities of the manager), and a responsible, realistic solution can be worked out on a shared basis. This solution is likely to be superior to what the Industrial Relations man or the manager could work out alone, and the solution is more likely to be acceptable and *to work*."

In no area of management do these criteria apply more forcefully than in manpower planning.

Dealing with Imbalances in the Labor Market for Scientists and Engineers

THOMAS J. MILLS

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Dealing with Imbalances in the Labor Market for Scientists and Engineers

THOMAS J. MILLS

Government programs to ameliorate labor market imbalances have been diverse, ranging from narrow recruitment and training efforts to meet immediate in-house laboratory requirements, to broader steps aimed at improving the caliber and number of scientific personnel available for the future. In this discussion we are concerned with the latter, although the contribution made by training programs in the armed forces, in the national research centers, and in other government operations has been substantial.*

* One solution to manpower shortages debated in the Congress from time to time is the establishment of a federally supported Academy of Science, organized along the lines of the military service academies and designed to produce a given number of scientists and engineers. Thus far, the proposal has failed in the authorization process.

Federal concern with the short supply of competent engineers and scientists first surfaced in the mid-1950's, as the number of bachelor degrees granted in science, and especially in engineering, began to decline. This was largely the result of demographic factors, particularly a smaller college-going age group, and the diminishing effect of the World War II G.I. Bill. At the time, however, a new anxiety over national defense was emerging, as well as growing public awareness of the importance of such World War II technological developments as radar and the atomic bomb.

In 1957, the launching of the first sputnik sent a wave of alarm throughout the country that U.S. technology was falling behind, and general public dissatisfaction erupted over the quality of science education, especially in the high schools. Though extreme, Admiral Rickover's comments during this period reflected the country's misgivings over what many regarded as the excessive permissiveness of U.S. education. Some of you may remember, for example, published high school student interviews featuring "coeducational cooking" as taught in certain "progressive" California schools. Establishment of the President's Committee on Scientists and Engineers was an expression of the public's concern at the highest levels of government.

THE FEDERAL EFFORT

The federal programs for alleviating future engineer and scientist shortages which I will discuss represent by no means an all-inclusive catalog, but are those programs with which I am most familiar. In general, they are of two types: those concerned with interesting the young high school student in training himself for a scientific occupation, and those offering financial support to the college and graduate student whose choice has been made. Before describing these programs, it may be helpful to review briefly the organizations supported

by the federal government that play a specific roll in encouraging the development of scientific and engineering manpower and know-how.

Directly under the President is a Science Advisor, a prominent scientist recruited from a university for a limited period; he serves as Director of the Office of Science and Technology, as Chairman of the Federal Council for Science and Technology (which is composed of the heads of the principal federal government agencies with science responsibilities), and as Chairman of the President's Science Advisory Committee, a group whose purpose is to bring industrial and academic scientists into contact with government programs. The Science Advisor coordinates, interprets, and serves as a channel of communication between the diverse components of American science and technology and the federal government.

Although there are many government agencies involved in specific programs, the major responsibility for program operations is held by some eight to ten agencies. Included in this group are the Department of Defense, the largest and principal unit involved in R&D related to national defense; the National Aeronautics and Space Administration (NASA), focusing on space exploration; the Atomic Energy Commission (AEC), responsible for the development of atomic energy; the Department of Health, Education, and Welfare (HEW), which undertakes health-related research; and the National Science Foundation (NSF), a supporter of basic research and science education. These units function through staff and contract and grant arrangements with private agencies working in their particular spheres.

Each federal agency has specific responsibilities related to its mission and tends to identify and resolve its own problems. Consequently, government policy regarding scientific and technical programs is not always unified, and we are confronted sometimes with a series of seemingly conflicting poli-

cies. Nonetheless, with an annual expenditure approaching $17 billions for R&D alone, the federal stake in science and technology is substantial. For the most part, these funds are contracted and granted to industry and educational institutions for support of specific projects.

MOTIVATIONAL PROGRAMS FOR YOUNG STUDENTS

The federal government has used several methods to bring about ultimate improvements in science education at the elementary and high school level, all of which were designed to motivate young people toward careers in science.

Course Content and Teacher Training

Assessment of existing school programs by professional scientists indicated not only that science textbooks were as much as a hundred years out of date but also that the typical high school teacher was usually poorly equipped to teach modern science. Therefore, science policy-makers decided early in the game to maximize the limited funds available for training scientists by focusing on the secondary schools. They reasoned that in view of the lead time required to produce a scientist, high school science courses should be made sufficiently challenging to interest youngsters in studying science in college and in pursuing scientific and engineering careers. This approach, it was believed, was preferable to "buying" students into science through subsidizing extensive scholarship programs.

The resulting attack has revolutionized secondary school science since 1953. Starting with high school physics, the program introduced modern concepts, relying on elaborate use of films and supplementary equipment. Similar innovations followed in biology, in chemistry and, most important of all perhaps, in mathematics. Improvement of course content

then moved to the elementary schools and to undergraduate college science courses. At all levels, rapid changes occurred. These were induced by federal government action, and took place on the whole without charges of federal meddling in local school matters.

Teacher preparation was the other major problem attacked at the secondary level. Through training "institutes" held during summer vacations, thousands of teachers have been able to supplement and refurbish their earlier preparation and to benefit from firsthand exposure to scientists and to university-level full-time science courses. Other institute programs offered opportunity for in-service and even full-time training during the regular academic year. The institutes were an innovation in science education, in that they emphasized improvement of teaching rather than training of research scientists, the goal of most graduate science courses.

Supplementary Course Enrichment

In addition to improvements in course content and teacher training, a series of special programs was developed to enrich and supplement high school science courses. These efforts included among others the loan, on a rotating basis, of science libraries to high schools, particularly those in the smaller school districts, science film libraries, demonstration lectures by traveling lecturers using specialized equipment, special science lectures in the metropolitan areas during Christmas vacations, and science newsletters. A highly successful program entailed special classes and laboratory work at four-year colleges during summer vacations for promising high school students. Typically, the programs operated for five to six weeks; they did not duplicate regular classwork but offered enriched experience in areas of interest to the student.

Implications for College-Level Study

Motivational programs at the secondary school level also sought to involve scientists, particularly, and some engineers, in curriculum planning and teacher training programs, and in this way to bridge the gap between high school and college-level science courses. It was not accidental that new Physical Sciences Study Committee physics courses and teacher training materials in physics were developed by M.I.T. scientists. Harvard faculty members helped revise biological science courses; Yale and Stanford faculty, mathematics; and Ohio State people, chemistry. As a result of the changes made in curriculum, course content in higher education was reexamined and revised.

DIRECT SUPPORT PROGRAMS

Among the programs designed to assist college and graduate students defray the cost of their education are those which provide support in the form of (1) stipends awarded as fellowships and traineeships, and (2) employment under research grants and contracts. Awards are made principally at the graduate school level.

Fellowships and Traineeships

About 35,000 fellowships and traineeships were awarded in 1968, mainly by the National Science Foundation and the Public Health Service. Though the two terms are used interchangeably, in government terminology fellowships usually are for graduate study and are awarded on a nationally competitive basis; they do not require services in exchange. They go to a very select group of students; for example, National Science Foundation fellowships are available to the top 5 percent of graduate and baccalaureate students.

Traineeships are administered on a more decentralized basis, in that trainees are selected independently by a given university, subject to the broad specifications of the federal agency providing the funding. Agencies responsible for traineeship programs include the U.S. Office of Education, the National Science Foundation, the National Aeronautics and Space Administration, and the National Institutes of Health. Traineeships provided by the National Institutes of Health for health-related scientific study go back to the late 1940's, and as early as 1952, fellowships in science and engineering were granted under one of the first programs of the National Science Foundation.

Research Grants and Contracts

The largest single source of direct federal support for graduate students in the sciences is employment as research assistants under government research grants and contracts. While policies differ regarding the extent of graduate student participation in government-sponsored research, and student support is not usually the primary objective of federally-supported academic research, most federal agencies encourage use of project funds to provide graduate student stipends. In the academic year 1967-68, probably 25,000 graduate students in science and engineering received some assistance from this source. The agencies providing the major portion of such support were the Department of Defense, the National Science Foundation, the National Institutes of Health, the Atomic Energy Commission, and the National Aeronautics and Space Administration.

Other Programs

Other programs improve the quality of education or reduce the cost to the student by providing funds to higher

educational institutions for purchases of equipment and laboratory refurbishment, usually on a matching basis. Loan funds under the National Defense Education Act are available to both undergraduate and graduate students. Of growing importance, and representing a departure from traditional project funding approaches, are the institutional development grants to improve science education. These have become one of the major forms of support for academic science study in this country.

Support of undergraduate programs is less likely to be categorical than for graduate programs and usually is in the form of general noncategorial scholarships, assistance with certain faculty expenses, and funds for buildings and equipment. There has been a reluctance to "buy" undergraduate students into science or technical fields. The overall objective is to assist the student in obtaining his undergraduate education in the field of his interest, on the theory, noted earlier, that if science study is made sufficiently challenging, then it will draw its share of students interested in pursuing scientific careers.

Overall, the magnitude of federal support to higher education is impressive. In 1966, federal funds for educational activities of all types were estimated at $3.0 billion, with support of "academic science" accounting for $2.2 billion of this total. Recipients of science and engineering graduate fellowships, traineeships, and research assistantships numbered approximately 50,000 to 60,000 in the fall of 1966—nearly 40 percent of the full-time graduate students in these fields, including social science. Approximately 80 percent to 90 percent of all full-time graduate students in the natural sciences and engineering have received some form of stipend support from either federal or nonfederal sources.

SPECIAL STUDIES AND REPORTS

A brief word should be said about the influence of the numerous studies and reports issued by government agencies on the supply of engineers and scientists. Projections and forecasts by the Bureau of Labor Statistics, the Engineers Joint Council, the National Planning Association, and the National Science Foundation, though they do not agree in detail, indicate a continuing labor shortage in engineering and scientific fields. Altogether, studies by these groups have been most influential in encouraging the building of facilities and in inducing prospective students to consider carefully the advantages of careers in science and engineering.

One of the most effective was the report of the President's Science Advisory Committee, *Meeting Manpower Needs in Science and Technology,* issued in December, 1962. This document stressed the urgent need for doctoral students in engineering, mathematics, and the physical sciences, and in direct response to its findings, President Kennedy and Congress approved the National Science Foundation traineeship program for expanding graduate study in these fields.

While other studies and reports have not had such dramatic results, their cumulative effect has been substantial.

EFFECTS OF IMMIGRATION

Science and engineering ranks are also being swelled through immigration. In recent years, some 5,000 professionals in these fields have entered the United States per year, particularly from the United Kingdom, Germany and Canada, as well as from the Asian nations, especially India, Taiwan, Korea, and the Philippines. In range, the group includes the very well qualified graduates of German and United Kingdom institutions, as well as the less qualified

from underdeveloped countries. Even though not all of these immigrants will become citizens, presumably they will become permanent residents and thus increase the supply of scientists and engineers.

The new immigration bill can be expected to encourage the influx of immigrants. Despite some problems—accusations of brain-drains, etc. — free access to this country within the terms of present legislation is clearly in our best interest. At the same time, I am not unsympathetic to the problems which loss of manpower talent creates for some of the developing countries, particularly with regard to physicians. Those coming into the country now number from 25 to 30 percent of the number educated in the United States. This statistic is perhaps not surprising to those who have observed hospital staffs and seen the number of Philippine, South American, and Asian M.D.'s manning our hospitals at the present time.

MEASURING RESULTS

The pertinent question, of course, is how successful government programs have been in increasing the supply of university-trained scientists and engineers. To what extent have these programs increased the number of these professionals, as reflected by higher education enrollments and degrees awarded in these fields?

As is frequently true in dealing with social and economic problems, there is not a direct cause-and-effect relationship which permits an unequivocal answer; an entire paper might be devoted to discussion of appropriate methods of measuring the results. About the best that can be done is to look at some before-and-after statistics, and to offer some observations.

The year 1955 represents a convenient benchmark for reviewing results. It came before the adoption of large-scale programs designed to expand science and engineering man-

power, but after the 1952 enrollment low which followed the post-World War II educational bulge resulting from deferred schooling and the G.I. bill. Demographically, 1955 was a year of recovery from the 1954 low point in the college age population.

In the academic year 1955-56, higher education degree credit enrollments totaled 2.7 million, with bachelor's degrees in all fields numbering 311,000; doctorates in all disciplines totaled 8,900. In the decade ending with 1966, higher education enrollment in all fields increased to 5.9 million, or 119 percent; bachelor's degrees to 556,000, or 79 percent; and doctorates to 18,200, or 104 percent.

Concerning the natural sciences and engineering, comparable data on enrollments are available only for engineering, which increased from 243,000 to 312,000, or 28 percent. For basic natural science and engineering baccalaureates, however, comparable degree data show increases from 51,000 to 100,000 in degrees granted, or 97 percent, and for doctorates from 3,500 to 8,200, or 134 percent.

Thus, there was an increase from 1956 to 1966 in the number of baccalaureates and doctorates in the natural sciences and in engineering, and the rate of increase for both was considerably faster than that for all degrees. The increase in engineering doctorates of 280 percent over the period is particularly impressive. Engineering baccalaureates, however, increased only 36 percent; engineering enrollments were only 28 percent higher at the end of the decade.

The percentage of all degrees awarded in natural science and engineering at the beginning and end of the period, as a percentage of total degrees, is another way to judge the effect of programs to increase scientific manpower. In these terms, basic natural sciences accounted for 8 percent of bachelor's degrees in the academic year 1956, and 12 percent in 1966.

Engineering bachelors were 8 percent in 1956, but only 6 percent in 1966. Similar data on doctorates awarded show natural sciences accounting for 33 percent in 1956, and 32 percent in 1966. Engineering doctorates were 7 and 13 percent, respectively. In summary, the ratios show an increase in the natural sciences at the bachelor's level, and a level trend at the doctorate level. In engineering, there was a decline in bachelor's degrees awarded, but an increase in doctorates.

Much has been written recently about the decline in the popularity of the natural sciences among students, as well as about motivational programs which emphasize natural science at the expense of engineering. In this connection it should be pointed out that natural science is holding up well in student popularity at the bachelor's level, although shifts between fields have occurred. For example, math majors are up sharply; physics is maintaining its level; and chemistry is declining somewhat. In any event, it is too early at this date to forecast a general decline in popularity. Engineering, however, is another matter, and a continuing decline at the bachelor's level will eventually have serious implications for industry as well as for graduate study.

Whatever may be said as to success — or lack of it — in encouraging young people to enroll in the natural sciences and engineering, there is no doubt that higher educational institutions, assisted by the federal government, have been highly successful in turning out a better qualified professional over the past decade. Improvements in science education have inevitably influenced higher education and are also affecting elementary schools. Graduate schools are attracting larger numbers of the able baccalaureates for advanced study, and emphasis on research improves instruction.

In conclusion, we may speculate on just how much government programs actually can influence career choice in a

society that values access to higher education for as many citizens as wish it. Less affluent and less open societies than our own tend to regulate the output of their universities by restricting admissions in number and in fields of study. For some, the choice in these countries is between university training in engineering or no university training at all.

We may wonder also whether we are not approaching some inherent limit on the number in our population interested in and capable of performing engineering at he modern professional level. The competition for able manpower in our prosperous world poses occupational choices not available one or two generations ago. It is imponderables such as these which continue to challenge the science educators and government policy-planners.

Fulfilling Requirements for Specialized Manpower

NELSON HEYER

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Fulfilling Requirements for Specialized Manpower

NELSON HEYER

Once a company has forecast its manpower needs, it must then establish an appropriate plan to meet the anticipated requirements. Little has to be said about the importance of such a plan, since a lack of manpower, particularly of highly skilled personnel, may endanger fulfillment of the company's long-range plans.

Before describing some of the steps taken by my company to meet its manpower needs, I will first explain our method for determining the extent of manpower demand and for deciding what, if anything, should be done to supplement the normal recruitment process. In IBM, as in most major companies, college and technical school recruiting, as well as a range of local employment programs, are in force. I will not

dwell on these normal activities other than to stress that in many situations the ongoing programs, and not the special ones, are the key to ensuring an adequate manpower supply for the company.

IS THERE A NEED FOR SPECIAL ACTION?

There are several ways to evaluate the need for special manpower programs. All evaluations should be made against existing programs, however, to determine if a given program will yield the required levels of manpower.

Perhaps the simplest approach is to study past experience to see what, if any, manpower requirements have increased substantially. Any skills that are new to the company, especially those generally considered to be in short supply or associated with the introduction of new technologies, should also be carefully examined. Because they represent recent needs, these skills usually have not been included in projections, and many of them will be critical to the success of new undertakings. For many, the demand will be short-term, occurring largely during the initiation and developmental stages in a new product area.

Emerging skills related to new technologies can be identified at an early stage by analysis of the impact throughout the company of these new technology thrusts. Those working close to new technologies, who are especially aware of areas of market penetration that can be opened up, as well as universities and research organizations (internal and external), are particularly helpful in anticipating and defining the manpower requirements that will be imposed. From this information, and the business forecast, a total measure of needed skills can be developed.

High-cost labor areas should also be analyzed. I do not refer here to the management sector but to the total work force.

Once the quantitative aspects of skill requirements are known, the question is whether the demand can be met through external resources or whether qualified personnel must be developed through training programs, upgrading, or reassignment from parallel skill activities.

CRITICAL MANPOWER CLASSIFICATIONS

In deciding whether there is a need for special action programs, we have been concerned in IBM with four special classes of manpower:

1. *Managers.* In our company, we rely on internal resources to meet the demand for management manpower. Our ability to do this depends, however, upon having available a continuous flow of talented personnel. Also, because of the long lead times required to develop managers, the growth of the company or of a particular division has to remain in phase with its ability to supply the needed talent. In some areas, where supply cannot keep pace with demand, and shortages are inevitable, we have the option of moving managers from slower growing divisional units. Obviously, this approach is more applicable in a multidivision company than in a smaller organization; in IBM, it has proved to be quite effective in enabling us to balance our management needs.

2. *Engineers.* The engineer classification, which I would broaden to include not only engineers but also scientists and mathematicians, is another category of continuing concern. This is a high-cost labor classification, whose supply is limited, depending primarily on the training capacities of the national education system. The fact that the supply of engineers has increased only 28 percent over 10 years speaks for itself, and we are yet to see the cost implications to industry of this limited growth.

Although people with general science training have been

equipped in some circumstances to handle specific engineering assignments, it is usually not financially feasible to train engineers internally. Therefore, the demand is usually filled either from the college campus or by recruiting in experienced labor markets.

3. *Technicians.* The demand for technicians is heavy within both our company and industry. National studies by IBM indicate that, as a result of the general shortage of technicians, industry will have to train up to 50 percent of the number it requires. Because training is costly, particularly for the more sophisticated type of technician, and the supply is limited, the technician group must be given major consideration in manpower planning.

4. *Tool/Model Makers.* Long a traditional requirement in most manufacturing organizations, this skill involves an apprenticeship-type of training of from two to three years, which means that company needs must be continually evaluated. Tool/model maker training programs also are subject to financial belt-tightening when profits slip. And as business revives, many companies who have cut their programs as a short-range solution for financial problems find that they do not have enough trained personnel on hand to meet business objectives.

There is no simple way to determine demand for these categories, but any of several methods would be appropriate so long as the results enable the company to compare its own and its industry's demand against the available supply.

THE DIMENSIONS OF DEMAND

Although companies typically examine their manpower needs on an annual basis, it is wise, if a longer-range plan exists, to ascertain total labor supply and demand relationships over the total plan period. In most situations involving critical manpower shortages, from two to five years are neces-

sary to implement corrective programs. And there are some types of shortages which may require as much as 10 years' lead time in order for changes to be achieved in the underlying labor dynamics.

In evaluating the company demand for certain types of manpower, it is risky to rely on a divisional or local examination, especially if the company draws the needed skills from markets outside the area in which its facilities are located. Recently, we polled our major divisions on the supply-demand situation they faced in the labor market. Not one reported a problem; everything looked good. But this turned out to be wrong. Each was looking at a small segment of the whole, and when the picture for the total company was assembled, it was substantially different.

The fallacy of looking at only the division, or even at one company, applies in the national sense. Skill areas in which a tight supply is anticipated should be examined on a total industry basis wherever possible. Although data of this type are not always readily available, there are ways to make such determinations. In dealing with engineer and scientist categories particularly, for which there is a national market, it is highly desirable for the relationship between the company's and the industry's demands to be established. For example, one approach is to determine company requirements, and then, on the basis of the general size of other companies in the industry and the rate at which the industry's market is expanding, to develop a reasonable projection of what total demand might be in the future.

In addition, there are industrial associations and professional societies which survey the demand in their given fields. One is the Engineering Joint Council, whose group, the Engineering Manpower Commission, specializes in studies of engineers and technicians. Government surveys also classify manpower in broad industry groupings and thus provide a

basis for evaluating the current demand of these industries. By determining a growth rate for the industry in question, its future manpower demand can be estimated.

Measurements of demand can be made either annually or for the total period being considered. The latter would tend to average the ups and downs and permit a better comparison with supply. (Supply also vacillates on a year-by-year basis, but these changes are not substantial.)

THE DEMAND/SUPPLY RATIO

Assuming that the supply of personnel in the four general categories cited earlier has been defined from data provided from surveys conducted by the Bureau of Labor Statistics, the National Science Foundation, and other sources, how can we determine a demand/supply ratio?

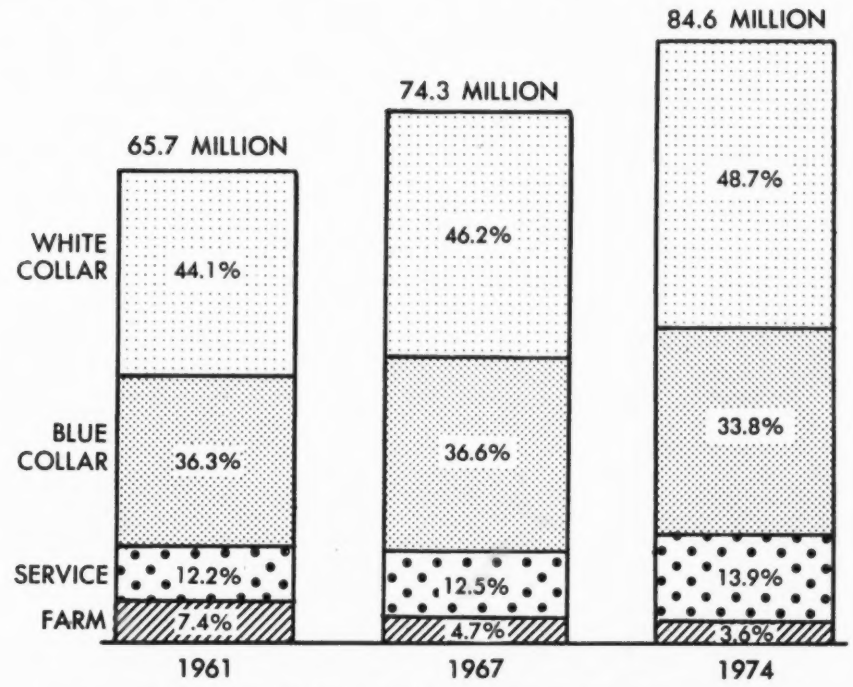
IBM has found it convenient to express demand as a percentage of the available supply. This provides some uniform indices which enable us to compare company requirements by year and by manpower classification. Given this demand index, the question then is whether or not the company needs to, or can, expand its share of total supply to meet expanding manpower requirements—in other words, it has to define where its threshold of demand is in relation to supply.

Possibly the best way to answer this question is to examine the kinds of problems being experienced in meeting current requirements. Since the technician category is a most critical one for us, it affords a practical illustration of the process of analysis that is followed.

Let me first examine the overall labor force trends pertinent to the skill classifications most related to our industry and particularly to the technician field. The projected growth of the labor force is shown on Exhibit 1 (U.S. Civilian Employment), which covers our current plan ending in 1974.

Exhibit 1

U.S. Civilian Employment

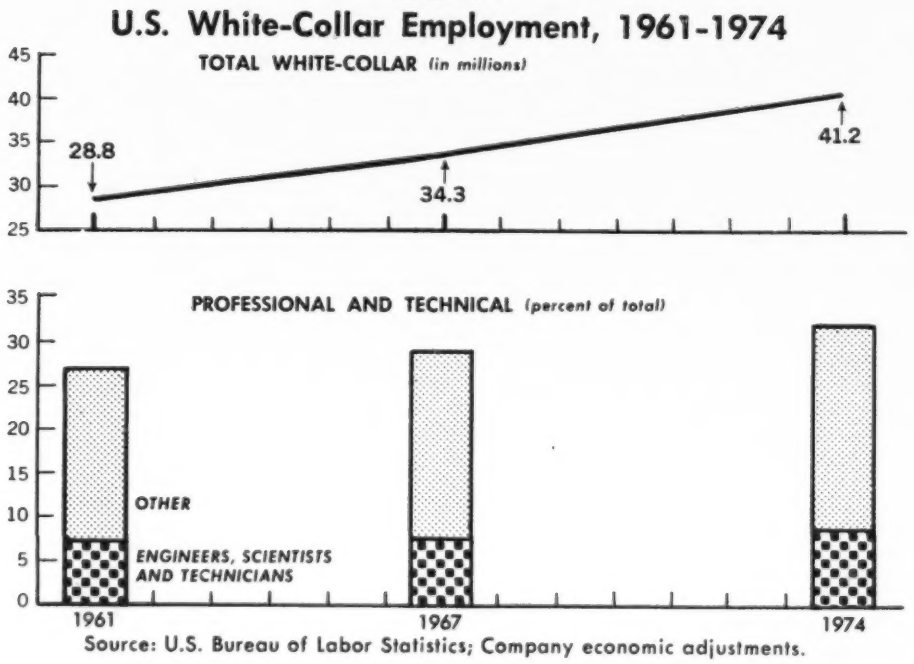


Source: U.S. Bureau of Labor Statistics; Company economic adjustments.

We have forecast for 1974, a labor force of 84.6 million, and a 4.7 percent unemployment rate. Of the 84.6 million, 48.7 percent represents the white-collar segment — a substantial increase from the 1967 level of 46 percent. In numbers, this is absolute growth of from 34 million to 41.2 million. Since IBM draws its manpower largely from the white-collar sector, these figures to some extent define the demand we will be facing until 1974.

As shown on Exhibit 2, within the total white-collar work force, the professional and technical category will be an increasing percentage—moving from 27 percent in 1961, to 32 percent in 1974. And within this group, the engineers, scientists, and technicians will have grown from 7 percent in

Exhibit 2



Source: U.S. Bureau of Labor Statistics; Company economic adjustments.

1961 to about 9 percent in 1974. That this creates a challenge in terms of meeting demand is fairly obvious. Considering the rate at which engineers are being trained, I am not sure that we can expect an adequate supply.

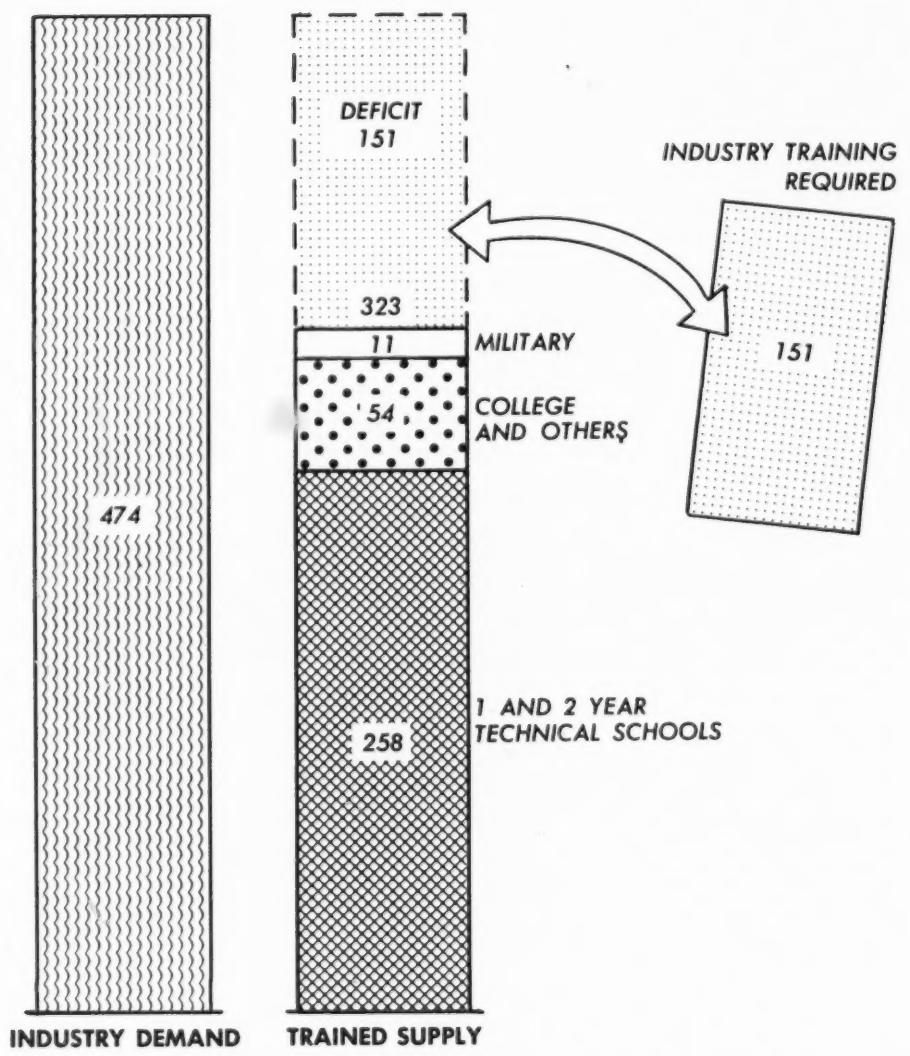
DETERMINING THE DEMAND THRESHOLD FOR TECHNICIANS

As was shown in the previous chart, growth of the technician group will be minimal over the plan period. In order to illustrate the supply and demand situation more clearly, Exhibit 3 shows a demand and supply comparison. The industry's demand is shown in terms of the total number of industrial technicians needed over the 1968-1974 period. Data from studies by the Bureau of Labor Statistics and the Engineering Manpower Commission indicate that for the industrial sector this demand will far exceed the supply. Sources of trained

Exhibit 3

Industrial Technicians
U.S. Supply Versus Demand, 1968-1974

(in thousands)



Source: U.S. Bureau of Labor Statistics (BLS 1512), and Engineering Manpower Commission.

people can provide no more than 70 percent of the industry requirement. Therefore, during the next six years industry must train over 151,000 technicians to meet its needs.

At IBM, we concluded that if all of our future technicians had to have a one or two-year technical school background, we were demanding a larger share of the supply than obviously was obtainable from the market. Considering that military-trained individuals have become a decreasing percentage of the total labor market and that their training is less technical, it becomes evident that our methods of providing technicians must be closely examined.

WHAT IBM HAS DONE

At present, IBM is implementing several programs to supplement the supply of trained technicians.

1. First, the customer engineering job — the function of installing, maintaining, and repairing computers — normally required a technical school background, with reasonably good grounding in electronics and mechanics. Foreseeing, over a year ago, the critical supply and demand relationship for personnel with such training, we began to change our way of handling this job. At that time the customer engineer was responsible for the total range of equipment. The first step then was to examine this equipment to determine if the maintenance work to be performed could be restructured. If so, we believed this would alleviate some of the pressure our company was placing on the available supply of qualified technicians, as well as reduce the cost of the added training that was required when needs could not be filled.

A task force of representatives from each of the divisions went to work on the problem and concluded that the original customer engineering job could be divided into three new jobs. This meant creating a new position concerned solely with

data recording, for which high-school graduates with a high aptitude could be trained, and which would represent the entry level. Two other jobs, each requiring a technical school background, were set up at successively higher levels. Thus, through in-company training, incumbents in data recording jobs could develop and progress into these higher-level skilled jobs.

2. A second action was to reduce internal after-employment training of technicians by working with the technical institutes to improve electromechanical training programs. After looking at our requirements in this area, and evaluating the training offered by the technical schools, it was clear that the technician entering our work force had to receive additional training in order to perform. Since from 2,000 to 4,000 people per year were affected, we concluded that it would be worthwhile to help the technical institutes assume more of this burden. Accordingly, we began an investigation of all curricula in those technical institutes in the United States from which we drew people; we also met with industry people to see what their experience had been. Out of this came a proposal for the establishment of an electromechanical curriculum, and through the efforts of a consortium of government representatives, the institutes, and interested companies, a training program was set up.

Both the government and the institutes themselves have been most responsive to the program. At present, about 200 to 250 people are being trained; increasing numbers of technical institutes are picking up the curriculum; and we expect that by 1975 over 3,000 people will have received this schooling.

Since this training effort was a shared program, all participating companies enjoyed the benefit of lower training costs. We think the program has made a decided contribution, not only to our own industry but to all users of automation techniques.

3. From our work with the technical institutes emerged several other programs. For one, our examination of the training institutes disclosed that all of these schools were operating 30 percent under capacity. If their vacancies could be filled, here was a potential source of supply. To tap this resource, however, it would be necessary to overcome the popular attitude toward a technical career. So, again the same group that worked out the electromechanical curriculum approached the NICB and, through that organization, the National Advertising Council, requesting it to mount a nationwide, broad-range program that would appeal to youngsters at the high school level and stimulate their interest in technical schooling. Using the same media, attempts were also made to reach the parents and guidance counselors, on the assumption that they would be interested in knowing the opportunities available to young people.

We also have sought the introduction of broader-based curricula in technical schools. Our experience indicated that a multidiscipline approach was needed — that electronics-chemical technicians were in demand, as were metallurgical-chemical technicians. Yet none of these combined specialties was being taught.

We suspected also that other companies were facing the same problem, although their demand might not be for precisely the same combination of skills. Our view was that, generally, it would be far more economical to broaden the capacities of two people by giving each multidiscipline training than to sift out and match the work to the talents available. As a result we are starting to define the multidiscipline demands in our own industry and in the entire economy.

Finally, at the request of the New York State University organization, IBM is providing advice and counsel on instituting the electromechanical curriculum in vocational schools

in the State, the objective being to provide electromechanical training earlier in the educational cycle. While this curriculum was not developed by us, but came out of our earlier work with the technical institutes, we were gratified at the State's request since it evidenced concern with a continuing and serious problem.

One other program should be mentioned, although it is not one in which IBM took the initiative. This is Project Transition, which resulted from President Johnson's concern for facilitating the placement of returning veterans. At first, we were leery because we needed trained people, and these men were untrained. Moreover, we felt the government could not train them. After a closer look, however, we found that one of our divisions could utilize additional personnel, if they received some training. A curriculum as well as classroom training equipment were developed and set up at specified bases around the country. Today, for one of our divisions, this program will meet 25 percent of that division's needs, without its having to expend any funds on additional training.

BEFORE AND AFTER

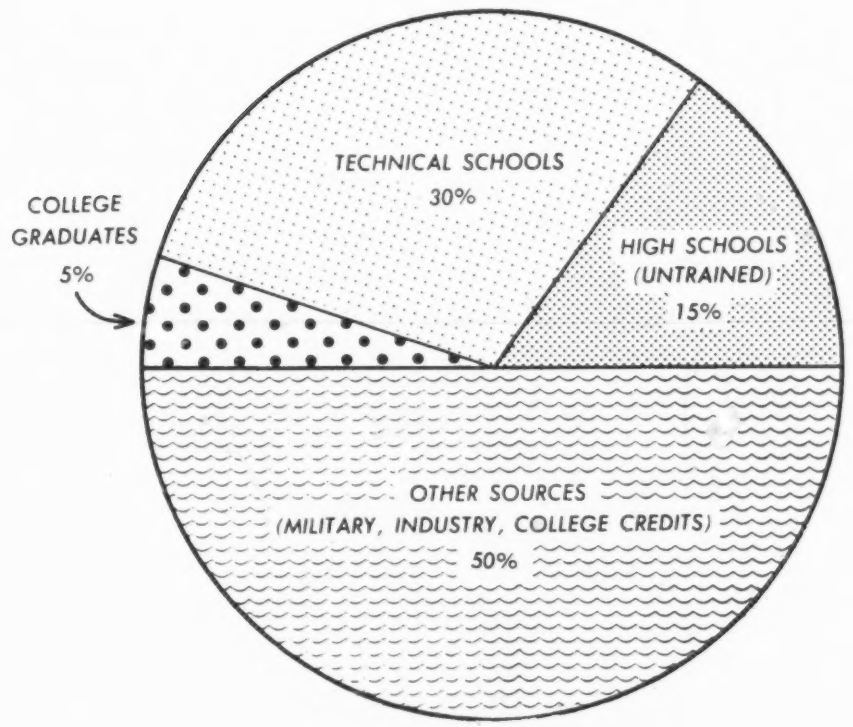
What these programs have meant in terms of our demands is shown in Exhibit 4.

1. In total, our hiring requirement between 1968 and 1974 is 42,000 technicians. Of these, 5 percent will be recruited from the colleges. This group will fill a specific, highly specialized and very limited need in one area of our business — the servicing of the most complex computers in the world which have been installed in some of our customers' facilities.

2. The technical schools will supply about 30 percent of the total number of technicians we will hire—that is, annually our demand is about 5.2 percent of their output. We have operated at this level for some time and believe that in the

Exhibit 4

Sources of IBM Hiring, 1968-1974



HIRING REQUIREMENT – 42,000

future we can continue to draw this percentage from the technical institutes.

3. The demand for untrained high school graduates is new and derives from the restructuring of the customer engineering job. We expect to draw about 15 percent of our total needs from the high schools.

4. The remaining 50 percent will have to come from normal recruitment programs, which draw on the military, other industries, and college drop-outs. Many in the latter group can be trained as technicians, particularly if they have had two years of an initial science and engineering curriculum.

SUMMARY

The foregoing describes some of the steps taken in one manpower area (technicians) to alleviate projected manpower shortages. While they may not appear on the surface to represent a dynamic shift in new sources of manpower, they represent areas in which there is the potential for increasing supply and thereby relieving shortages not only in our firm but nationally. The cost of several million dollars over a seven-year period may well be small in relation to the savings achieved.

A number of other programs are under consideration for programmers, system analysts, engineers and scientists. We think it important for any expanding company that is a large user of skilled people to evaluate the demand-supply parameters of its manpower markets and to develop appropriate programs to ensure that their business plans can be filled.

Evolution of Career Paths

H. DWIGHT MEADER

Consultant, Executive Compensation, General Electric Company. Mr. Meader joined General Electric in 1941 at the River Works, Lynn, Massachusetts. Following service on the staff of the Small Apparatus Division and Measurements and Industrial Products Division, he moved to the New York office as a member of the Exempt Salary Study Group. In addition to holding positions in exempt salary administration, he was manager of Management Manpower Development Planning and of GE's Business Effectiveness Consulting Service, a member of the Cordiner Defense Advisory Committee on Professional and Technical Compensation, President Eisenhower's Cabinet Committee, and consultant to the Department of Defense in reviewing federal pay policies and structures. Mr. Meader is a member of the National Association of Manufacturers Organization Development Network, National Training Laboratories Organization Development Network, and the Foundation for Research on Human Behavior. He is a graduate of Dartmouth College (A.B., 1940) and Dartmouth's Amos Tuck School of Business Administration (M.B.A., 1941).

Evolution of Career Paths

H. DWIGHT MEADER

Judging from the large outpouring of research and writing concerned with management development in industry and elsewhere, it is obvious that companies are now beginning to recognize more fully both the importance of these activities and the problems associated with them. Unfortunately, experience to date has not produced very many conclusive results; the major effort still lies ahead.

THE CAREER PATH DILEMMA

The many conflicting theories and practices regarding career development create some frustrating dilemmas for those concerned with this area of manpower planning. To one group

of experts career development can result only from self-development. But another group finds this approach far too risky. Still a different viewpoint is represented by those executives who maintain that development takes place best on the job, and that it cannot be left to chance, but these men do not specify what jobs or what combination of jobs offer the best training ground. Further, it is said that the important need today is for generalists, yet most of the early assignments and training of potential managers continue to be related to functional specialities. On the one hand, it is considered necessary to select those with potential for advancement and to plan special career paths for them; on the other, it seems prudent to avoid the "crown prince" notion.

Peter Drucker has said, "Whatever can be gained by developing the chosen few will be offset by the stunting, the malformation, the resentment of those who are passed over."[1] We want to place our bets on those who show promise early in their careers, but we are aware that this is not scientific — that there are many early frontrunners who fail, and many successes who were "late bloomers."

I can hardly exhaust the dilemmas in career planning, but let me add one more: Each individual has a career goal which he may be seeking and a certain career path that he follows; at the same time, his employer has an overall need, both short and long range, for a total manpower force of a given size and mix, and this total organization may or may not be in harmony with the career paths of individual members of the organization.

Having ventured to suggest a few of the problems, let me discuss some of the useful lessons that we in General Electric have learned about career paths, and some of the steps that

[1] *The Practice of Management*, Harper & Brothers, New York, 1954, page 185.

can be taken in the future to improve career structures for the benefit of the employee as well as the company.

CHANGING MANAGEMENT DEVELOPMENT CONCEPTS

In this discussion today, we are not talking simply about a path between the starting point of an individual's career and his ultimate position. Such paths have always existed and involve no particular "evolution" in "pathing". What we are discussing here is the emergence of an unprecedented demand within companies for professional, administrative, and executive talent, and a sociological revolution. Both developments require organizations to employ methods and approaches that place each individual on a career path appropriate to his and the organization's needs.

This evolution began before World War II. At this stage, many companies were still family-owned and controlled, and managers usually rose to the top simply by graduating from college, entering the family business and letting what seemed to be the natural laws take their course. In many respects, this pattern continues to prevail in Europe, especially in the United Kingdom. In the United States, however, the tremendous economic growth of the past two decades and the development of larger and more public-type businesses created an unprecedented demand for professional managers and professional employees. Many men, merely by being available at the right time, found themselves carried to the top, and managements began to assume that talent would develop automatically through hard work and exposure to various job assignments. This slightly revised law of natural selection suggested that, with time, the most capable people would be revealed, much as oil rises to the surface of water. But, as the 1950's advanced, companies began to discover that this was not true —

this natural law could not produce skilled managers as fast as economic growth required. Thus, out of sheer necessity, companies began to tinker with the process and to establish programs specifically for developing and training managers.

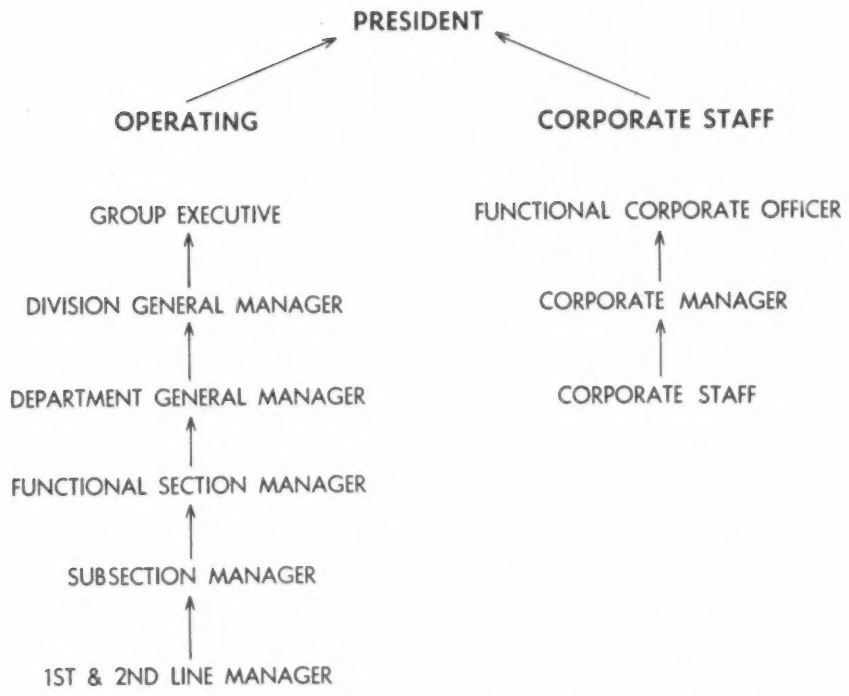
Many organizations, like my own, reacted to corporate growth needs and changing conditions with substantial modifications in management philosophy and organization. General Electric, for instance, chose to follow a decentralized pattern of organization and management, with responsibility and authority for decision-making delegated as closely as possible to the scene of operations. Such an approach led to great emphasis on the need for companywide compensation programs, performance appraisal systems, and programs for manager education and training. The organization structure that ultimately developed profoundly influenced career patterns in the company, and this structure was path-oriented. Moreover, as decentralization took place, and many new career opportunities opened up, it became evident from our job-filling experience that we needed to develop managers equal to the tasks of tomorrow rather than those of today. Mr. Cordiner, the Chief Executive of GE when decentralization began, stated: "I thought that a lot of the fellows we took from functional jobs and made general managers would respond to the challenge of being measured. I was wrong. I should have realized that you can't expect a fellow who has been running just a part of it to, all of a sudden, be accountable for the whole thing."[2]

FACTORS IN CAREER PROGRESS

Exhibit 1 shows that one obvious career path to the top level is through ascending operating positions. And, indeed, it has been almost axiomatic in our company, as in most, that top executives should have strong operating backgrounds.

[2]See *Forbes*, October 15, 1967, page 31.

Exhibit 1
Executive Career Path



In addition, the company believes in moving managers from operating to corporate staff assignments, and in the opposite direction, in order to ensure their having the widest possible experience at given stages in their careers. Theoretically, an individual would advance by a series of zig-zag tacks back and forth, alternating between operating and corporate staff positions.

The concept also implies a relationship between age and the various points along a manager's career path. To quote Mr. Cordiner again: "I think you ought to put a man in charge who [can serve] 10 or 12 years [as Chief Executive]."[3]

[3] *Ibid.*

According to that philosophy, a chief executive should be no more than 50-55 years old when appointed.

Reflecting the requisite experience at each operating level (excluding time on the corporate staff), the maximum age/position relationship looks something like this:

Position	*Maximum Age At Appointment*
President	50-55
Group Executive	46-51
Division General Manager	42-47
Dept. General Manager	38-43
Section Manager	34-39

Having a number of candidates of appropriate ages ready for selection for top positions means that a large supply of young incumbents must be in place at the section manager level early in their careers, and that these ranks, as the main source of future executives, must be constantly replenished.

In addition to defining career path/age relationships, General Electric also enunciated a concept of "parallel paths." This principle held that no employee with basic interests and abilities in a functional area in which individual contribution was a key element need feel that becoming a manager was the only means of achieving the financial or other personal goals he desired.

Looking back over the 15 years since GE's decentralization was implemented, what seem to have been key elements in management progress?

The figures in Exhibit 2 indicate some typical career and age patterns for a top management group of 10 group executives, 55 division general managers, and 167 department general managers. This analysis points up the following:

1. At the time individuals were appointed to various operating positions, their ages were sufficiently low to accommo-

Exhibit 2

Factors in Management Career Development

Factor	*Present Position*		
	Group Executives	*Division General Manager*	*Department General Manager*
Age			
Average Age	52	51	48
Low Age	48	38	33
Age when Appointed to:			
Section Manager	35	38	38
Department General Manager	39	42	44
Division General Manager	45	48	..
Group Executive	51	..	..
Previous Functional Experience			
By Function			
Marketing	20%	40%	26%
Engineering	40	16	18
Business Section	..	16	22
Manufacturing	..	9	19
Finance	20	11	8
Relations	10	2	2
Other	10	6	5
Number of Functions			
One Function	70%	49%	46%
Two Functions	20	38	36
Three Functions	10	9	14
No GE Functional Experience	..	4	4
Educational Background			
Bachelor	80%	73%	72%
Master's	10	11	14
Ph. D.	10	5	4
None	..	4	10

date the age-level progression shown in Exhibit 2. The ages shown are lower than those of managers in comparable positions at the time decentralization went into effect.

2. The three prime functional backgrounds are marketing, engineering, and business section. (The latter is a small product line which is being developed into a size large enough to warrant department status.)

3. Most of the top managers have a bachelor's degree, and about 20 percent of them have earned advanced degrees.

4. The job rotation emphasis of many manager development programs concentrated on giving individuals as much experience as possible in such functional areas as accounting, engineering, manufacturing, marketing, employee relations, and legal; the trend at General Electric is slightly in that direction. (Still another statistic not shown but pertinent to the career backgrounds of top managers is that some 20 percent of them have worked in several countries.)

There is no shortage in industry of similar analyses of career patterns. One study that has attracted attention is Eugene Jennings, *The Mobile Manager.*[4] Some of his significant findings, based on studying executive mobility patterns over the past 15 years in the 500 largest corporations, are as follows:

> Marketing and sales produce more presidents than accounting, personnel, law and manufacturing.
>
> Staff positions have become developmental. Today, 75 percent of all presidents have spent more than five years of their careers in staff assignments.
>
> By 1966, one out of three presidents had been three years or more in foreign subsidiaries and divisions.

[4]Published by Bureau of Industrial Relations, Graduate School of Business Administration, University of Michigan, Ann Arbor, 1967.

The number of college degrees among managers is increasing. By 1965, 95 percent of men at the top were college graduates; at the present time, 21 percent have earned doctorates.

> Today, men at the top are products of compressed experience. If they have one particular quality it is that they are ready and responsive to mobility. It takes 70 percent of the pure mobile hierarchs 20 years to go from first-level manager to president, during which time they move geographically seven times and positionally 11 times, and receive countless numbers of special project assignments.

It is useful to compare Jennings' and General Electric's findings. I mentioned that the career patterns of General Electric executives were affected by, and related to, the company's organization. The theory of cross-fertilization between operating positions and functional services assignments actually has worked out. For example, both the President and Chairman of the Board held corporate staff assignments on their way to the top. At a given time, among a total group of 10 Group Executives, four had held corporate staff positions, and almost half of the corporate staff officer group came from operating posts. There appears to have been substantial movement back and forth between operations and staff, although this has not always occurred in a clear-cut zig-zag career pattern, in which one step has led directly to the next.

Factors Affecting Technical Careers

What else has been learned in General Electric about career paths? One study conducted by our behavioral research group followed the career progress of 1,360 technical college graduates hired into company training programs in the mid-1950's. Ten years later, 600 of the original group were still with the company.

The most significant finding concerning this technical group was that success — in this case, measured by a relative salary standing — was significantly influenced by:

Having bosses who were promoted

Participating in task force assignments

Moving through different organizational segments of the company

Having a technically challenging first full-time assignment.

While many "experts" claim these are self-evident facts, for the first time such widely held beliefs were verified statistically. There is also some verification of these conclusions in Jennings' study of mobility.

In addition to identifying success factors, the General Electric study isolated the dimensions of the engineers' work goals and their impact on career success. It was found, for instance, that men who were motivated primarily by such intrinsic job factors as achievement, responsibility, and advancement fared much better than those men motivated mainly by the extrinsic factors of the job, such as pay or working conditions. Our research also revealed a fourfold pattern in salary and career success among engineers. High success was achieved in two ways: through technical competence and business sense, or through orthodox conformity and total identification with the company. On the other hand, engineering careers were retarded in two ways: through bright academic tinkering and an unrealistic perception of the business world, or by preoccupation with security and details.

THE PROBLEM OF THE YOUNG GRADUATE

The findings of the foregoing study not only have provided some guidelines for structuring full-time assignments but also

have served as the springboard for several other follow-up research projects.

Earlier I noted that the survey sample at the conclusion of our 10-year study of technical college graduates was 600 of the original group — only about 44 percent. Since a 56 percent loss of employees is a significant item in its own right, we were concerned with knowing why so many had left the company. And, more basically, we wanted to know why so many potential employees never even considered coming to industry for a career?

There are many options open to the young educated population, and careers in education, government, and services seem to hold attractions that outstrip those of business. Some remarks by 1968 graduates of the Harvard Business School are illustrative of what appear to be typical attitudes:[5]

—Being president of a firm has tremendous appeal for me. But I'd probably come to a position like that by creating it myself. I'm not willing to climb the corporate ladder. I'm not willing to go to U.S. Steel and spend 30 years waiting to be president, even though I could make it. But I would work for Podunk Data Company if I could move in right now as the vice president, with the potential of being president in five years.

—Our definition of a career is opposed to what our parents saw, just coming out of the depression. They said, "I'm going to be a production scheduler — and my ultimate hope is to be manufacturing vice president." This was the long well-directed rise through the ranks. You don't see that anymore.

—That's absolutely right. The one thing I don't want to do is find myself in the same position for the rest of my life.

—We had a case in school — where we saw the career patterns in a company — and to me it was just awful. I couldn't see anyone planning my career pattern for 20 years out. I talked to one company about a job. The interviewer took me through a series of boxes on the organization charts and said, "This is how it could be, how does it sound?" I said terrible.

—If you look at a career pattern of Robert McNamara or John Gardner, you see that they clearly have expertise in manage-

[5] See *Forbes*. June 15, 1968, page 43.

ment and administration. Whether it happened to be in a university or a foundation or government or a large corporation would seem not to be an issue.

What is the answer to dealing effectively with such a group of versatile, aggressive, and restless young men? According to Edgar Schein, writing four years ago in the Harvard Business Review, "The challenge is to recognize the great potential of the college graduate and to create organizational circumstances for him that will utilize rather than defeat the very qualities which make him valuable — his education and his youthful enthusiasm and ideas."[6]

Mr. Schein's suggestions for improvement focus on the first boss, as did General Electric's research. In his opinion the first boss must be more competent than his new employees and, being secure in his own knowledge, anxious to teach them as much as possible. He should not be threatened easily by the emotional outbursts that often accompany failure, and he must be able to handle defiant and inflated egos in a supportive and understanding, rather than punitive, way.

The problem is that in many companies first-line supervisors do not feel secure — hence, their attitudes and actions generate an authoritarian and conservative climate.

Shaping Future Career Paths

What do these research findings, these new conditions, mean in terms of future career paths? We know something about the nature of past and current career paths, but what are the implications for the future of the new circumstances that are evolving?

We at GE have had Professor Victor Vroom working on developing a description of career movement, which he and a colleague, Kenneth MacCrimmon, described in the June,

[6] "How to Break In the College Graduate," November-December, 1964, page 68.

1968, issue of *Administrative Science Quarterly* under the title, "Toward a Stochastic Model of Managerial Careers." This study is one indication of how the research approach can provide inputs on turnover, promotions and demotions, and interfunctional mobility.

Over a period of years a large body of sample data were gathered on actual career movements of managers at all levels in an organization: what positions they held, the kind of work they had done, the particular parts of the organization in which they were employed, and their levels in the organization. These data were fed into a model and used to calculate the probabilities for the movement of managers through various career paths.

The patterns revealed can be used in many ways. For one, a comprehensive description of a present system makes it possible for us to examine the system for irregularities and to suggest alternatives fitting the objectives of the organization. (For instance, what "dead end" positions are identified?) The model also enables us to determine the consequences of continuing the present system without modification, since it is possible to show, for a given position and for any future period, not only the expected number of incumbents but also their backgrounds in terms of previous positions held.

From the standpoint of both managers and individual employees, such a model can be of considerable assistance in evaluating the outcome of different career alternatives. Among other benefits, it permits realistic assessments of individual career planning, since one can calculate the number of years a manager in a particular position can expect to stay in that position, or the number of years he can expect to remain in the organization. The model also can be used in estimating the number of people required each year from outside the company to fulfill projected manpower requirements.

With such tools at our disposal, and drawing on what we know about the evolution of career planning, we should be in position to utilize young talent more effectively and to start our young people on realistic career paths. From what we know now we believe that it will be possible to:

Study those who have been successful managers and determine the reasons for their success.

Develop career paths and mobility patterns for advancing individual employees through one job to another, on the assumption that success in one assignment is predictive of success at the next higher level.

One of the tools currently used at GE, and also in other companies, to speed career development is the "Talent Review Program." Young men are recommended by their managers for participation in the program. They then meet in small groups for three to four days and, working with trained staff counselors, go through various assignments, including business games, interviews, group projects, and several individual tests and tasks. During the sessions, the participant gets some feedback about his performance from the counselors and his peers and, as a result, gains some insight into himself. At the conclusion of the program, the staff counselors jointly assess the individual and offer suggestions concerning his career path. The objective is to help the participant capitalize on his strengths, so that he can accelerate his career growth. His manager receives some feedback, too, regarding those areas in which he can make a positive contribution to his subordinate's progress.

GE is also setting up an experimental program to increase the rate of advancement to general management positions. The program departs markedly from traditional approaches, in that young men with potential do not have to work themselves up the functional ladder and then at the higher levels

switch to a generalist's role. Young employees — normally MBA's—are given special assignments at the outset that carry multifunctional responsibilities which might be performed by fairly high-level executives. As an illustration, one employee might be asked to appraise the feasibility of adding, or of discontinuing, a new product line. Such a task would require bringing into play a knowledge of accounting, manufacturing, marketing, employee relations, and engineering, and coordinating the views of the separate functional managers involved. A series of such assignments — if performed under the supervision of qualified managers—could well offer a measurable and comprehensive basis for equipping young employees to move into general manager posts much more quickly than the process of gaining experience by the traditional climb through the functional ranks.

The School-to-Business Transition

GE is also beginning to do something to help young professionals bridge the gap between school and business. One approach that has been particularly helpful is "work planning." The manager meets regularly, perhaps quarterly, with his professional employee to discuss his work. The purpose is not to make a critical evaluation of the person's performance, but to arrive at a joint understanding of work to be done, to review progress, and to search for better ways to accomplish assignments successfully and on time. The manager and his professional agree on clear, realistic, and specific goals that fit the needs of the business and offer a true challenge. In this way, the employee knows his progress is being watched with real concern by the boss and that he is being evaluated on the basis of actual performance. He cannot claim that "no one knows what he is doing," or that he cannot perform because of forces beyond his control.

An additional tool designed to advance individuals along

their career paths is the preparation by managers at all levels of written individual development plans for their most promising people. This is a three-step process in which the manager:

Generally assesses the individual and his career outlook

Considers alternate ways of affording development opportunity

Outlines a plan, with the individual's concurrence, which provides specific development opportunities.

The development opportunities proposed should be those which would have a significant impact on the individual's career path. A person does not grow by doing the same thing in the same way in the same location. In order for a job to contribute to an individual's growth, it must be given new dimensions and new elements that (1) necessitate his acquiring new knowledge and capabilities, and (2) produce needed business results. Through applying this "newness" concept in conjunction with work planning, managers can create effective career development opportunities within the employee's present position, or it may be desirable to transfer an employee to a new job assignment.

Special assignments, including participation on study teams, task forces, or appointments to acting manager positions, are generally the most valuable means of developing capabilities and of exposing promising individuals to higher levels of management. In preparing development plans, our managers are being advised to look especially for assignments that involve the following criteria:

Require looking at the total business

Call for staff or preparatory work leading to key business decisions

Require interaction with key persons inside and outside the company

Entail participation in business reviews

Involve teaching others

Offer problem-solving opportunity.

By having managers prepare written plans for their subordinates' development, we are trying to create a climate in which there is constant attention to furthering careers, and the process of career planning becomes institutionalized.

LOOKING AHEAD

We have already noted the impact on career paths of social and economic changes. The more mobile, educated, and self-reliant manpower pools have caused institutions to bend their traditional outlooks and to recognize new social and economic realities. As a result, our manpower programs at GE are more attuned to younger personnel and are much more flexible than in the past. But this may be only a forerunner of what lies ahead, for the trends in industry and elsewhere suggest that individuals will be involved increasingly in creating the structure of the organizations with which they are associated. The application of behavioral science theory is being pioneered today, whether the form is participative management, theory Y management or conflict management. These efforts will mature into changed organization concepts, and career paths will be influenced accordingly.

In the future, I think we can expect these developments to influence management career paths:

1. A vital advancement will be the enlargement of the uses of data processing equipment. As my colleague, Larry Ferguson, noted in an article in the Harvard Business Review two years ago:[7]

[7] "Better Management of Managers' Careers," March-April, 1966, pages 140, 152.

> Eventually, reliable predictive patterns of career progress will begin to emerge. Eventually, also, a calculus for the management of human resources will be developed that will provide for differentially weighting personal skills and attributes in relation to corresponding job demands and development opportunities. Intelligently used computers can handle these data processing and analysis problems, still leaving to the personal judgment of those involved the fine-line choice between individuals with different characteristics.
>
> ... He (the manager) could turn, say, to a small console beside his desk and ask the computer center directly about the availability of individuals who meet the qualifications he believes to be most important. The information would then be fed directly to him in a matter of seconds, together with indications of the effects of the considered move on the individual's career and the corporation's manpower needs and plans.

2. Future hires will be less inclined to accept traditional functional career paths. As a result, greater flexibility will be needed in tailoring job assignments to match the individual's abilities and career goals.

3. There will be pressures to move younger men into positions of high responsibility. To a greater extent than ever before, industry will have to dip into the expanding 20-34 age group for managerial talent and make promotion commitments with less on-the-job experience to draw on.

4. We will see a trend toward earlier-than-65 retirement. (In General Electric, the average retirement age already is about 61 years for all employees.) Earlier retirement will compress the span of individual career paths.

5. As the need for specialized skills accelerates, multiple career paths—different from the traditional manager progression to the top — will emerge. Organizations will accept and properly reward individuals who travel such different career paths.

6. The compensation differentials between managers and those with specialized skills will shrink or disappear.

7. There will be more "outbreeding." Traditionally, executives have tended to spend their entire careers within an organization. Down the road, I can envision career patterns which would be integrated with outside activities. Thus, organizations might maintain chairs at various business schools and rotate personnel through them to do university teaching and research. In addition, organizations will encourage their higher-level executive talent to take leaves of absence to serve in government, foundation or social agency activities.

8. In response to organization needs, it will no longer be adequate to concentrate merely on career development of individual skills; it will also be necessary to develop "team" skills.

9. Research efforts are under way to develop a system of "human resources accounting." If, in the future, such efforts prove to be solid, one more tool will be available for use in planning career paths.

10. Attempts to predict a man's success and probable career path probably will never become solely scientific or mechanical. There will be increasing pressures, however, to supplement intuitive judgment because selection mistakes will become more costly.

Converting Hard-Core Unemployed into Productive Contributors

EUGENE G. MATTISON, JR.

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Converting Hard-Core Unemployed into Productive Contributors

EUGENE G. MATTISON, JR.

In mid-1966, serious recognition was given to the existence of a significant "hard core" unemployed group in our society—its members included the poverty stricken, the disadvantaged, the hard core. They were unemployed, or had a very poor and unstable work record, mainly in unskilled labor. A closer examination revealed that they were locked in a cycle of poverty and disadvantage and that no amount of national prosperity would change this. They were probably the second or third generation in families with such characteristics. No statistics existed on the size of this segment of our society. Best estimates put the figure at 3 to 3½ million people. It was reasonable to assume that perhaps one-third could be made employable and could become taxpayers instead of

tax dependents, provided they could be identified, motivated and trained for real jobs, and assured of placement following the training.

In order to learn more about this problem and to see what might be done to relieve it, Lockheed Aircraft Corporation, in early 1967, established two separate programs to employ the "hard core" unemployed—one in Marietta, Georgia, at the Lockheed-Georgia Company, and one at Sunnyvale, California, at the Lockheed Missiles and Space Company. These two companies were asked to undertake this experiment independently, seeking to successfully employ about 100 such persons at each location by year end. They did not compare plans, but each designed its program to meet its own needs.

Here is a brief summary of the two programs.

LOCKHEED MISSILES AND SPACE COMPANY

This is really two programs in one -- the Vocational Improvement Program (VIP) and the Welfare Reemployment Program (WRP).

VIP trainees were employed directly on the company payroll from the start of their training. They held the title of the occupation for which they were being trained, and they immediately received the beginning rate of pay for that classification.

On the other hand, WRP trainees, mostly women, were not actually hired as company employees until the end of their training. However, during training they continued to receive their welfare payments.

The median age of the trainees was 26 years. They were both male and female, and almost equally divided among Negroes, Mexican-Americans, and whites. Sixty percent had no more than a tenth grade education. Two-thirds of the women were either separated or divorced, and 83 percent

were on welfare. Two-thirds of the men had arrest records. Fifty percent of the men and 72 percent of the women made $2,000 or less in the year prior to entering the program. Significantly, more than 80 percent of the total were heads of households.

Applicants were obtained from 33 different agencies in the San Francisco-Sunnyvale area, particularly the Urban League, the Mexican Opportunities Center, the Opportunities Industrialization Center West, and various skills centers.

During the last nine months of 1967, the Missiles and Space Company hired 108 hard-core applicants into its training program. This figure represents only 13 percent of those applying, but 70 percent of those rejected were turned down because they were not hard core enough or because their arrest records were not acceptable under the company's standards for employment. No formal reading requirement was imposed. The only requirement was that applicants meet four of the five following criteria:

School dropout

Unemployed head of household

Income less than $3,000 in last 12 months

Poor work history

No primary working skills

Initially it was planned that all VIP trainees would enroll in a prevocational training course at the Opportunities Industrialization Center West or at the East Bay Skills Center. This training was directed to improving communication and computational skills; developing good grooming, health, and hygiene habits; and improving attitudes towards work. Many did not complete the training; others did not take it at all. Although we believed the prevocational training was desirable,

especially from a community involvement standpoint, its lack did not seem to have an adverse effect.

The company training for both the VIP and WRP groups consisted of a series of four-week vocational training courses aimed at such specific occupations as General Helper, Electrical Assembler, and Key Punch Operator. During the training period, trainees were taught those specific skills required to perform in the occupation in which they were to be placed. Training was conducted in an in-plant training area.

Of the 108 trainees employed in 1967, only 10 had terminated by the end of the year. Of these, five resigned voluntarily, four were dismissed for poor attendance, and one was arrested and convicted of a felony. No one was terminated for inability to perform the work assigned. Up to the present, a total of 153 have entered the program — 28 are currently in training.

A comparison study with a group of 50 new employees who met traditional hiring standards and also entered the same occupations during the same period indicated no difference between the trainees and the comparison group on ratings of quality and quantity of work. A larger proportion of trainees had more absences, but this difference was not statistically significant.

Subsequent interviews of supervisors by hard-core instructors revealed that the trainees showed little inability to perform on the job and little inability to adjust to supervision and fellow workers. The only real complaint from supervisors concerned poor attendance.

Some supervisors were lavish in their praise. "Best trained and most productive men I have ever received," commented one. Another added, "These men really want to work; they work hard, and the quality of their work is very good."

The Training Manager of the Missiles and Space Com-

pany, commented as follows in reviewing the important aspects of their program:

> The biggest factor we had going for us in our program was the fact that an employee started drawing a good wage as soon as he came into the program. There are two reasons why this is important:
>
> 1. More than one employee who had been receiving welfare aid told us ours was the only training he could afford to take; that is, the equivalent of unemployment insurance for the duration of the training program under the usual MDTA effort just couldn't match the welfare money he had been getting.
>
> 2. These people are not long-term goal oriented. They had a job now, not "maybe," or not "X" months down the road if they completed their training. This is one of the big items which held our turnover during training to almost zero.
>
> The people were trained for good jobs—jobs they could go out into their neighborhoods and talk about. These weren't the traditional janitor jobs; they were jobs that called for the mastery of skills.
>
> We stayed away from the classroom atmosphere. These were school dropouts; it wouldn't have been smart to take them back into a failure atmosphere. The training was for real; it was highly job-related.
>
> Classes were small; trainees could receive a lot of needed individual attention promptly. There were no long, frustrating waits for information.
>
> The instructors were tops. Not only did they know the work, but they were interested in what they were doing; this was more than just another assignment to them.
>
> Because the classes were small and the instructors were interested in really helping the trainees, it was possible to quickly establish some real rapport with them. When a man had a personal problem, he wasn't sent off to see someone whom he saw only when he was in trouble; he talked to the instructor.
>
> When a man did need help, he got action quickly. If this

meant towing his car off a freeway, we did it. If he had to go to jail, someone in the Training Department whom he knew was down there with him to talk to the judge to see what could be done to fix things. In one instance, for example, we worked it out so that the man could continue with his training while he spent his nights and weekends in jail until he had served out his sentence. News of this kind of help gets around. Many people have dropped off a card to the supervisor of the program, thanking him for all the help he gave them.

The training was conducted right at the plant in the training building where employees are continually coming and going at all hours, taking classes to improve their capability. Our VIP's had a chance to see other members of their minority group taking these classes; thus they were, in at least one sense, part of the mainstream already.

The training atmosphere was businesslike, and it certainly was friendly also. More than one graduating class brought in a cake and invited their instructor and a few of the rest to share it.

We made it a point to bring the supervisor in to meet the trainee he would eventually get upon completion of the training. And before graduation, the trainee was taken out to the area where he was to work. The supervisor did more than shake hands with his man; he had an opportunity to talk with him to explain the nature of the work he'd be doing.

There was on-the-job follow-up, on the part of the instructor. After his trainee went into the job, the instructor was expected to maintain regular and frequent contact with him. In some cases, this is where some of the most meaningful help was given. Personal problems arose long after the trainees had left the formal training program. They continued to turn to the instructor, whom they had learned to trust.

Although a concerted counseling effort is getting under way, and while admittedly we're comparing a little over a hundred VIP's with close to 10,000 technical people, we now have a higher percentage of our hard-core people taking courses on their own time than we have engineers and scientists doing so.

Fortunately, there have been openings in higher job classifications, and a number of our VIP's have been able to qualify for

them by taking some prescribed courses. Again, this word gets around. Poor people can get used to the idea of having more money, too, and we've found that a great many can be motivated to take the training that will enable them to get it. They just need to believe in it — that it will bring results.

We made provisions this year to bring in professional social workers on a scheduled basis. We found we could handle the in-plant problems, but working on the trainees' family problems will be too much for us when we have 200 trainees. We have set up an office for the social workers, equipped with phone and typewriter.

We are making it a point to be concerned about our VIP's, even after layoff. Fluctuations in production work loads made it necessary to lay off 25 who completed training. Two-thirds of those have been placed with other companies. Some of those not placed were offered jobs but preferred to wait for recall by Lockheed. To help those who are surplussed, we have prepared a small booklet which is given to them when we discuss their being laid off. We also supply them with a resume which they can take along when applying for a job at another company. We actively try to get jobs for them with local companies, and we do everything we can to make them feel they are our people, people in whom we have a real investment, people we want back. Further, we want them to feel they have a skill now — something which they can sell at a good price. I think they are finding this out. So far, since the first of the year, 12 of our VIP's have been laid off. Nine have found other jobs in local companies; of the other three, one has left the area, another has failed to report for three interviews, a third says she wants to work only for Lockheed and has enough money to last until such time as she thinks she will be recalled to her old job. Incidentally, we are doing everything we can to get our people placed. Two individuals, for example, received special training in micro-welding at company expense. We had surplussed them. Philco said they would hire them if they knew how to do micro-welding. So we provided the training.

In the final analysis, when you talk about motivating and counseling these people, you get off to an awfully good start if you just treat them like human beings. A little patience and understanding can do a lot to make a program such as ours succeed.

THE OTHER PROGRAM — LOCKHEED-GEORGIA COMPANY

During 1967, a total of 98 trainees entered the program. All were male; most were single; two-thirds were 21 years of age or younger. More than two-thirds were school dropouts. Median time since last employment was six months, and only about 10 percent had ever had experience in an industrial organization. Such experience as they generally had was in low-paying service jobs, such as bus boys and short-order cooks. Approximately two-thirds came from families on welfare, and about the same proportion had records of arrest. More than half had no more than a tenth grade education. Almost three-fourths were Negroes, and about one-third were heads of households. None would have met traditional hiring standards.

Some preliminary screening was conducted. Applicants were sent from the Georgia State Employment Service to the Atlanta Employment Evaluation and Service Center, where they were given a battery of standardized psychological tests for later research purposes. At this stage, the Center rejected about 25 percent because of failure to achieve a fifth grade reading level. Training openings were available for approximately 50 percent of the remaining applicants, and selections were made on the basis of indications of interest and motivation as evaluated in interview.

The training program consisted of a 12-week course conducted in a training facility separated from the main plant in Marietta. The building was equipped in much the same manner as the work stations the trainees would later find in the factory, and trainees were exposed as far as practicable to standard work routines. They were required, for example, to punch a time clock. Training was in sheet metal work. Its goal was to develop skills in such basic operations as drill-

ing and riveting. No remedial education was offered, but skill training was supplemented by classroom work in blueprint reading and shop mathematics, according to individual trainee needs.

During the training period, trainees were not on the Lockheed payroll but received government funds under a Manpower Development and Training Act contract. Single men received $20 a week; heads of households received $35 a week plus $5 a week for each dependent. In addition, transportation costs were paid.

We employed the first 43 to complete the program. Of these, only five could be clearly termed unsuccessful employees — three of whom had to be terminated for poor attendance. Unhappily, a 1967 decline in the work force took a heavy toll among trainees. By year end, most of them had been bumped out ot work by layoffs under the union contract seniority procedure. Nevertheless, their qualifications by that time were such that the company had little difficuly in finding other jobs for them in the Atlanta area. (In fact, the company is now training hard-core people for other Atlanta area companies as part of a cooperative community effort.)

At present, a total of 218 have entered the program, and we now have a 75 percent training completion record. Fifty-five are currently in training, and 50 of those we trained are now working for other Atlanta area employers.

One interesting technique produced unexpected results. A large proportion of the Georgia trainees were very self-conscious and acted in a very suppressed manner — they looked away when spoken to, they talked to the floor, they failed to ask for help when it was needed. In an effort to give them more self-confidence, the company obtained the services of a specialist in psychodrama, who conducted three two-hour sessions each week that involved the trainees in role playing.

They were required to act out various situations in which they confronted each other, persuaded each other, and made decisions on the spot.

Training instructors and trainees themselves say that the sessions have indeed made a difference in behavior. Trainees who went through the psychodrama experience became much more confident in their dealings with their instructors, and the program did appear to accomplish the objectives for which it was undertaken. However, it may have succeeded too well, for many trainees lost their inhibitions, and going to the opposite extreme, indulged frequently in adolescent behavior. Now they need to learn control. If they do not, many supervisors may find such trainees more difficult to manage.

Asked to point out some of the more valuable lessons learned in the Georgia programs, the Training Manager made the following observations:

> These people come in with disbelief. They need to be shown every step of the way that "it's for real." In the initial stages two aspects of the program which assist them in accepting their change of status are trust and concern. Many are being trusted for the first time in their lives. Second, they are shown that someone is really concerned about them. This leads them to a new feeling of personal worth and brings about the first changes in their self-image.
>
> The prospect of a job such as they are working toward in the Training Center provides them with a status, a future, and a respectability, all of which were previously unknown to them. When asked about their feelings toward their situation in training, they are likely to say: "Man, I feel great!" They tend to look at training as already being a respectable job.
>
> One of the first questions a trainee is asked by his community neighbors is "What do you do?" This leads to a discussion of meaningful tasks related to building an airplane. And this increases the trainee's self-image.
>
> This program appears of particular significance to the trainees for two reasons:

1. It promises to lead to a respectable job with a future,

2. Because of the way the training is conducted, there is an opportunity to complete successfully a worthwhile undertaking. Many trainees have remarked that they never finished anything before in their lives.

WHY THE PROGRAMS SUCCEEDED

Statistics, observation, and opinion all testify to the success of these programs. Quite simply, a group that was unable to meet traditional hiring standards became able to meet established performance standards and actually achieved a better than normal turnover record. Naturally, the question arises, "What made these programs succeed?"

It is impossible to give a wholly definitive answer to this question. Perhaps one of the least apparent reasons is one of the most important — the dedication and total commitment of those who were associated with the program and who cared enough to do more than was actually required. Nevertheless, some reasons for success are clear to both instructors and observers:

—The training was specific. It was directed to developing proficiency for a specific job—a job for which trainees knew they were being prepared.

—Trainees were overtrained. They were given preparation to a level slightly above that required by the job for which they were being trained, in order to ensure they gained confidence in themselves and to preclude failure.

—Trainees were given personal assistance. One training supervisor estimates that he spent 50 percent of his time working on personal problems dumped in his lap by trainees, problems ranging from bailing trainees out of jail in the middle of the night to working with creditors to get garnishments reduced. The need for transporta-

tion is a common problem—reliable autos do not figure among the assets of the poor. It is imperative that some personal assistance be given so that the trainees will be able to concentrate on their training—or even show up for it. Counseling and assistance must build strength, not suffocate it. Aware that a sense of control over one's fate is highly related to achievement, instructors aimed their assistance at helping trainees help themselves.

—Instruction was by demonstration. Most of the disadvantaged have few associative hooks on which to hang new information; they must be taught by showing, by doing, and by repetition.

—Recognition was frequent. Training was structured in small sections to allow frequent opportunity for reassurance and recognition.

—There were jobs at the end of the rainbow. The job must be there and trainees must know it. When they found out that we really meant what we said about having a job at the end of the road, they really became involved and motivated.

WHAT LOCKHEED LEARNED

For all the learning that went on in the programs, perhaps it was the company and the company's training people who learned the most. They learned something about people with whom they did not ordinarily come in contact; and they learned something about motivating them, training them, and helping them to succeed.

They learned, for example, that counseling is a much bigger part of the job than they originally thought. Trainees consistently require a large amount of time in help with personal, financial, and vocational problems—problems often so absorbing that they interfere with learning. So evident was

this need that both companies plan to increase the availability of counselors and to provide counseling service for a greater variety of problems.

They learned the importance of individual differences. The trainees needed much individualized attention — many were reluctant to ask for help. It became clear that supervisors need special supervisory training in how to deal with disadvantaged trainees. Supervisors must learn how to communicate effectively and must understand the attitudes and cultures of the trainees.

Perhaps most important of all, the company and its trainers learned their efforts were not in vain. Experience with hard-core training programs in these two companies has proved that the disadvantaged and hard core can be trained to perform industrial jobs and that they can be moved into the factory, as effective, well-adjusted members of the working team.

HOW ABOUT COSTS AND BENEFITS?

In spite of government aid, such programs cost money — more money than the usual company-sponsored training program. This expenditure is to some extent offset by the reduced level of turnover that can be obtained, and indeed was obtained by our programs. It is an investment that brings returns to society many times over. Even in the reduction of welfare costs the programs show returns. If those trainees receiving welfare payments at the time of their employment at the Missiles and Space Company had continued on welfare throughout the year on the same basis as previously, total welfare payments to them would have amounted to more than $108,000 by the year end.

But this is, of course, the least of the returns from hard-core training programs. If we measure the benefits in lives

rebuilt, men and women restored to productivity, social tensions reduced, and manpower resources strengthened for the nation, the returns are incalculable.

Our experiment at Lockheed demonstrates that there can be value received for the money spent. The Corporation is sufficiently convinced of this to continue to expand the two programs.

OTHER PROGRAMS

I would like to discuss briefly two other programs that we have recently undertaken. In them, we have adopted techniques that proved successful in our Marietta and Sunnyvale experimental programs.

First, our Lockheed Missiles and Space Company is a member of a consortium of over 40 San Francisco Bay Area companies, organized to train and employ almost 500 hard-core unemployed. Sixty-eight trainees have already entered this program, and 28 are now working for member companies. Only one has been dropped, and one was promoted after only four days on the job and given an $80 per month salary increase in consideration of his obvious higher qualifications. We are doing the training for the consortium and will place the graduates with the various member companies. This is being done under an MA-3 contract which is an open-end arrangement. As other companies join the consortium, and as additional jobs become available, more trainees will be added. We hope to add several hundred more.

The second new program is in a Lockheed subsidiary established in San Antonio last April in conjunction with President Johnson's original "Test Cities Program." It is known as the Ventura Manufacturing Company and is engaged in the manufacture of aircraft ground equipment and related metal products. The work involves fabricating, ma-

chining, welding, and assembling. The goal is to have over 110 employees by the end of November. All are being drawn from the hard-core unemployed and disadvantaged of San Antonio. We are working with the Texas Employment Commission and Concentrated Employment Program (CEP) to identify, select, and prepare the trainees. All supervision, training, and counseling is being done by local hires, most of whom are minorities.

The CEP conducts the job conditioning training, providing remedial training in English, writing, reading and math, and Ventura provides the training for jobs, which includes mathematics for blueprint reading, and blueprint reading. The first 75 began the program in classes of approximately 15 each. Forty-four of these are now in the on-the-job training phase. Only three have been terminated — one was dismissed for unsatisfactory attendance and poor attitude; the other two quit for personal reasons.

We are quite pleased with the job performance of the first groups to start actual productive work. This is particularly significant when one considers the previous qualifications of these trainees:

Education: sixth to seventh grade

Previous work experience: day labor

Limited, if any, use of English, in many cases.

Training during the first six weeks includes isometric projections and decimal and fractional treatment of dimensions. I think that tells us a great deal about the potential of hard-core people.

In conclusion, I would like to review six points that seem to me to be most critical:

1. *Basic education.* The hard core have individual needs for remedial education, and specific techniques must be ap-

plied to bring them up to appropriate functional levels. The Board for Fundamental Education is one of several organizations that has developed some successful techniques for doing this.

2. *Job-oriented training*. Training should be job-oriented, to avoid the classroom atmosphere of previous failures.

3. *Real jobs*. Training should be for real jobs. The knowledge that a real job is waiting for the trainee is a strong motivator.

4. *Sufficient initial pay*. The hard core must have sufficient initial earnings to make up for the loss of welfare payments.

5. *Counseling*. Counseling is a major factor. Personal problems interfere with learning and attendance, not only during training but also after the trainee enters the regular job environment.

6. *Self-image*. The hard-core employee needs the support that an improved self-image can provide. He needs responsibility and self-respect.

Converting the hard-core unemployed into productive contributors is not easy—it involves hard work, patience, dedication, and the investment of dollars. But it is rewarding, and of benefit to society — both socially and economically.

Note: Discussion of the Lockheed experience appears also in *Harvard Business Review*, Oct. 1968, p. 148.

The Task Force Approach to Effective Manpower Utilization

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The "task force" has been defined as a "tactical combat group specifically made up of elements from one or more disciplines or services, often of naval, ground, or air forces, under a single command, or fulfilling a single precisely defined mission." While this definition rigidly identifies some central characteristics of the task force, it conveys little about why this form of organization is potentially both more personally satisfying and organizationally effective than more familiar approaches to organized human effort.

I might suggest, for example, that a task force is simply a committee that knows what it is doing. In this happy state of affairs, committee members are sharply and consensually focused on an objective, their contributions are valued for their positive impact on progress, and they are able to recog-

nize and support the resourcefulness of fellow team members. Difference of view, divergence of opinion, and variety of experience become factors of relatively creative synthesis and solution rather than of discord.

We have all had such an experience, though perhaps it has been frustratingly infrequent. Also, we have usually found ourselves perplexed about just why this kind of team effectiveness does not always jell. In the larger organization particularly, more obstacles than aids seem to emerge; the structures and procedures which grind out the day-to-day affairs of our businesses, and which indeed are often our best efforts at organization planning, are more often barriers than doorways to optimum use of organization resources.

Since a "task force" of some sort is within the experience of all of us, I would like to leave the definition for this discussion loosely labeled as a "method for optimizing an organization's team response to a particular objective." Let me assume that for all of us "what it is" feels more sure and familiar than "how to make it work." The latter is the crucial question, of course. Is it possible to design organization structure and procedures which facilitate rather than obstruct the formation of task forces? Is it useful for the organization's broader purposes to do so? Can one "engineer" toward team effectiveness and away from the proliferation of "committees?" Does one have to throw out the whole existing bureaucratic macrostructure with its attendant paper-generation, or can an organization evolve systematically toward a task force orientation wherever and whenever helpful?

Obviously, my own answers to these questions are positive. They are also prohibitively long, so to be brief I will deal only with some of the critical aspects of effective task force work. What are some of the prerequisites—what organization structure, climate, policies, and administrative procedures are necessary? What is the role of authority and expertise? Finally,

what about manning and motivation — do some people work better in task forces than in bureaucratic compartments?

ORGANIZATION STRUCTURE

The extinction of bureaucracy is now a popular prediction. Warren Bennis, for example, has noted that bureaucracy is long since an anachronism in light of our knowledge about human behavior, and that it is increasingly dysfunctional for business objectives.[1] While my own biases, from Bennis and experience, are by now clear, I realize that in eschewing bureaucracy as an abstraction, I imply the disappearance of its concrete structural corollaries, the bureaucratic hierarchy and the accompanying procedures and policies. What sort of new structure, and what new policies, if any, emerge to replace the bureaucracy?

As to task force structure, this is somewhat harder to picture in the concrete than in the abstract. Nonetheless, implicit in the task force approach are certain new, more dynamic concepts for guiding organization design. In describing the difference let me try to contrast two views of structure: the *dimensional* and the *hierarchical*. The point here is not to make neat and tidy distinctions, but to elicit, from a familiar view of organization as a bureaucratic hierarchy, the less familiar perspective of two crucial dimensions: (1) *operations*, used in the broad sense as encompassing the major functions the organization *performs*, and (2) *manpower*, indicating the types of human resources that the organization *possesses*. Now, if we draw a conventional organization chart and remove the lines and boxes of the hierarchy, and with them the common assumptions that every individual has one job,

[1] Warren Bennis and Philip Slater, *The Temporary Society*, Harper & Row, New York, 1968, 147 pages.

one superior, and one set of responsibilities, we are left with the people in this "organization" residing in a two-dimensional grid or "matrix," where clearly they wear at least two hats — that is, everyone shows up on both the organizational and the manpower dimensions.

To continue with this idealized game, let us identify a critical task to be performed — for example, "new product development," and give it a place on the "operations" dimension. In order to optimize staffing for this task, we might well want to select a number of people from a wide range on the "manpower" dimension. Our criterion for selection may now be, not where individuals formerly appeared in the hierarchy, but rather what kinds of resources, expertise, or *technology* (the third critical dimension of organization, which I will merely note here) are optimum for the task of new product development. We may, for example, want quality control specialists, process engineers, marketing experts, etc. in addition to the familiar faces of engineers and planners. Imagine such an optimum selection on this basis, and note that the task force "organization" may be initially depicted as a column under the "new product development" label.

Having staffed the task force, I invite you now to redraw the original bureaucratic hierarchy and to trace a line through it, connecting the individuals picked for the "optimum" task force. It will most likely turn out that the task force crosses many lines of authority and responsibility, perhaps doubling back on itself; it is even possible that the task force leader, chosen on the basis of expertise and experience, is someone well down in the hierarchy.

Hopefully, this illustration not only clarifies the dimensional or "matrix" viewpoint, but also helps illustrate why the bureaucratic hierarchy gets in the way of the task force approach.

ADMINISTRATIVE SUPPORT

I implied earlier that effective task force management requires new approaches to administrative support as well as to organization structure. In a matrix organization, operations are sufficiently decentralized and so varied in character as to render traditional administrative thinking obsolete. Such functions as manpower planning, operations control, and cost control must be able to respond to task force managers rapidly and flexibly. The familiar concern with what higher management—the executive committee, for example—wants to hear must be tempered with equal concern for fast feedback to the task forces. The traditional categories used to summarize accounting data for higher management, for instance, are not necessarily responsive to the task force manager's need to know how his particular budget is being spent.

To emphasize: the need is to put control information where the action is. To this end, organization of administrative support in successful task force oriented companies decentralizes both the physical location and the reporting relationships of support people. Accountants, personnel specialists, and other support staff professionals are quite likely to turn up as full-time members on large or critical task forces.

This "local ownership" of support and control resources helps ensure that task force managers will be able to get information that helps them be self-controlling rather than that which causes them to feel controlled by remote, less well-informed administrators.

Three areas of control — manpower, operations or projects, and costs—are especially critical for task force support. I will briefly discuss each of these.

Manpower Planning

This subject is thoroughly covered elsewhere in these discussions. I should note, however, that both manpower and

project planning are directly concerned with the two previously discussed dimensions of the matrix organization. Therefore, I believe that in its complete form the matrix organization needs top managers who are directly and exclusively concerned with these dimensions (including the previously noted dimension of technology).

Task Force Operations Control

Numerous techniques have been developed in the past few years for guiding the short-term course of task force or project efforts. Pert-charting and critical path scheduling, for example, have been developed to such a high degree that they can be compared in complexity to the navigational "software" used in guiding space vehicles.

In fact, so much attention has been devoted to the complex that many operations managers are overautomated and find themselves encumbered by a system that provides so much data as to be a burden on control rather than an aid to it.

As an antidote to this sort of smothering complexity, let me recommend the methods offered by Professor Robert Howell, in "Multiproject Control."[2] Howell's system, elegantly simple, consists of a weekly project status report and a program status form, each displaying various summary data for a specified period. These two forms use color-coding to indicate program status. The whole system is uncomplicated, uncomputerized, inexpensive, and useful to project managers and their secretaries. I have not seen anything simpler or more practical.

Task Force Cost Controls

Cost-control and cost-information procedures that are bureaucratically based should be redesigned to support a task

[2] *Harvard Business Review*, March-April, 1968, pages 63-70.

force structure. Without such special attention, astonishing practices can develop in providing information for effective control purposes. In one small company of 300 employees, the task force project managers received cost data in the form of a monthly computer printout, totaling for the firm and its two or three projects, 1,200 pages. Clearly, in this case the term "accounting" was being taken too literally; the computer was being used to enumerate rather than to summarize and communicate, and "control" was again impossible.

In another company, one of 13 task force managers received 17 handwritten documents each two weeks, all of which were geared toward corporate accounting needs rather than toward task force requirements. In this instance also, the job of extracting project data was hopeless.

By contrast, one of the best accounting systems I have seen, used by a firm that has hundreds of projects ranging from a few thousand to a few million dollars under way at any one moment, consists simply of a weekly one- or two-page summary "print-out" for each team leader of all charges to his project. On Monday, project leaders receive information as of Friday noon. The computer works over the weekend too!

Returning to the general subject of administrative support for task forces, too often managers and administrators fail to distinguish properly between the *problem* and the problem-solving *process*. For example, the design of a good accounting or manpower planning system may present solutions to the problems of controlling costs and allocating labor, but as solutions, these systems are neither self-perpetuating nor self-developing; they need continuing attention. As staff people, most of us are aware of this distinction—we know what happens when the right process is poorly implemented, or if a process deteriorates — but many managers are inclined to expect a procedure to run itself. They may not recognize that while a procedure may successfully solve the original problem,

it tends also to rigidify and to become obsolete. Thus a process has to be cared for — it has to be managed and modified continually in order for it to serve changing needs. The task force approach, with its high decentralization, emphasizes the fact that the first objective of administrative procedures is to help task force managers stay on top of their work.

MOTIVATING AND MANAGING THE TASK FORCE

Is there a "task force" personality type? Perhaps the best starting point for an answer is an article by Frederick Herzberg, entitled, "One More Time: How Do You Motivate Employees?"[3] Here, both in the title and in the summary, the author's impatience with traditional approaches to motivation comes through, as he notes that employees in *any* type of organization are not motivated by improving "hygiene" factors, such as wages and working conditions, that the kick in the seat of the pants does not work, and that job enlargement does not work. For Herzberg, the only active motivator is job enrichment, regardless of "personality."

I agree. The consequences of acting on this realization can be truly revolutionary in developing human potential. The task force approach is one in which job enrichment rather than job enlargement can take place smoothly because task forces offer far more variety of opportunity than conventional methods for effectively utilizing people.

Authority vs. Creativity

Stimulating creativity is perhaps the most frequent challenge to a task force. In the old days, task forces generally worked under rigid commands, as the dictionary suggests. Often, this rigidity was essential for survival. (Certainly, the pioneers did not get their wagons across the river by seeking

[3] *Harvard Business Review*, January-February, 1968, pages 53-62.

positive motivation and job enrichment.) Today, though some small degree of bureaucratic authority is still essential, meeting the challenges of creativity—not simply those of survival and competition — is more so. Moreover, the ideal task force has enough talent within itself to create its own "legitimate" authority as it needs to do so.

For example, Carlson's Raiders, a commando group harassing the Pacific Islands during the early days of World War II, found that it was necessary in planning a mission to arrive at full consensus, and that the best way to achieve this was through wide-open, no-holds-barred, creative planning sessions. However, in carrying out the mission itself, the opposite—inflexible, absolute discipline and crystal clear authority relationships—was necessary. Thus, the task force, in this case the commando group, imposed an authoritarian structure on itself, but this was the result of the group's own analysis of what was required.

The shift toward creative and organic task force approaches is in itself a symptom of successful survival, of prosperity if you will, and in a perverse way indicates that bureaucratically authoritarian systems have done their jobs fairly effectively. Nonetheless, where they continue to exist they need to be changed to offer greater opportunities for self-expression and self-determination. This in turn implies fewer pure administrators and more "Carlsons," although both are needed.

Selecting Task Force Members

The "Protestant Ethic," which spawned the bureaucratic form of organization, also emphasized that work was good and play was bad. We now realize that creative people, and especially creative technical specialists, do not recognize this dichotomy; unlike many administrators and perhaps all true

bureaucrats, they tend to insist upon joy and enrichment in their work.

Those looking for effective task force members will need, therefore, to examine the basic mission of each task force. If it is survival—a mission of getting the wagons across the river —the man who is willing to suppress his personal identity and opportunities for personal growth may be just the person that is needed; to assign a creative man to such a task force would probably backfire. By the same token, in looking for people to head up creative task forces, do not avoid the man who looks as though he might turn over a few ashcans.

In a recent study of groups, their creativity, and productivity, the most creative were found to include one or two very noisy people. When asked which persons they wanted to get rid of, the groups dispensed with the obstreperous members, of course, but creativity fell off. I am not recommending chaos. But there are many situations where progress is best made in a setting that is not neat and tidy, and I encourage you not to make *order* your automatic criterion for an R&D or creative task force.[4]

I want to conclude with a story that illustrates the most unmanageable aspect of task force management. A man was walking down the sidewalk when a panel truck pulled up next to him at a stop light. The driver had a baseball bat in one hand and was steering with the other. Reaching out the open window with the bat, he was pounding on the back of the truck. When the bystander asked the truck driver why he was doing this, the driver replied: "As you can observe, I've got a two-ton panel truck here, but as you cannot observe, I've got four tons of canaries inside, and I've got to keep half of them in the air."

[4]For a text which demonstrates and thoroughly discusses creativity in the task force approach, see: Raymond M. Hainer, Sherman Kingsbury and David B. Gleicher, *Uncertainty in Research Management and New Product Development,* Van Nostrand-Reinhold Books, 1967.

The predicament is a familiar one. The effective men are overloaded, and seldom are enough people specifically concerned with preventing this from happening. Many of you, I am sure, have had the task of counseling a manager who is about to "blow" because he was pressured and overworked. Though many companies permit such situations to continue for years, they certainly are not in anyone's best interests; it is hoped they will disappear along with bureaucracy, puritanical views of "work," and irrelevant authority.

To summarize, increasing use of the task force approach is one symptom of the obsolescence of bureaucratic organization and is hastening its demise. The task force approach is not as productive as it should be, however, because we have neglected to redesign certain fundamental processes which are *not* obsolete. One of the keys is new approaches to control. The task force without adequate cost and technical control is like a man who cannot make his muscles work. And to a man in such a situation, talk about enrichment and personal growth is meaningless.

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